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A

TREATISE

ON THE

ANATOMY, PATHOLOGY,

AND

SURGICAL TREATMENT

OF

ANEURISM,

WITH ENGRAVINGS.

By ANTONIO SCARPA,

PROFESSOR OF ANATOMY AND PRACTICAL SURGERY IN THE UNIVERSITY OF
PAVIA; MEMBER OF THE NATIONAL INSTITUTE OF THE ITALIAN
REPUBLIC, OF THE ROYAL ACADEMY OF BERLIN, OF
THE ROYAL SOCIETY OF LONDON, AND OF
THE MEDICAL SOCIETIES OF PARIS,
EDINBURGH, &c.

TRANSLATED FROM THE ITALIAN,

WITH NOTES.

BY

JOHN HENRY WISHART,

FELLOW OF THE ROYAL COLLEGE OF SURGEONS, AND MEMBER OF THE
ROYAL MEDICAL AND CHIRURGICAL SOCIETIES, OF EDINBURGH.

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JOHN MURRAY, AND CRADOCK & JOY, (SUCCESSORS TO THE LATE
T. OSTELL), LONDON; AND H. COLBERT, DUBLIN.

1808.

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1808.

TO

JOHN THOMSON, M.D.

PROFESSOR OF SURGERY

TO THE ROYAL COLLEGE OF SURGEONS,

REGIUS PROFESSOR OF MILITARY SURGERY

IN THE UNIVERSITY OF EDINBURGH,

ONE OF THE SURGEONS OF THE ROYAL INFIRMARY,

&c. &c.

THIS WORK IS RESPECTFULLY INSCRIBED,

BY HIS OBLIGED

AND SINCERE FRIEND,

THE TRANSLATOR.

ADVERTISEMENT.

THE reputation of Professor Scarpa is already so great, that the translation of any of his works cannot fail to prove useful and acceptable to the public. In the present instance, a translation appeared the more necessary, as the original is printed in a very expensive form, calculated to prevent the general diffusion of the important practical information which it contains.

ALTHOUGH, within these few years, many observations with regard to aneurism have been made, and a variety of cases published, yet it may be confidently affirmed, that there is no work in which the nature and causes of this formidable disease will be found to be so fully and accurately investigated, nor in which the aneurisms of the internal and external parts of the body, have been illustrated by so great a number of original and important facts, as in the following treatise of Professor Scarpa.

THE

AUTHOR'S PREFACE.

THE Society of Medicine of Paris proposed, for the year 1798,[1] as the subject of a prize essay, the following questions relative to aneurism. In what cases is the assistance of the surgeon necessary, and in what circumstances are internal remedies, diet, and rest, sufficient to effect the cure of aneurism? When the assistance of the surgeon is necessary, what are the cases in which compression may be employed with success as a method of cure, and when ought the ligature of the aneurismatic artery to be preferred to compression? Farther, when the ligature is indicated as the only method of cure, is it proper to make two ligatures; that is, one above and the other below the aneurism; or is the upper ligature sufficient? In the last place, in what cases is it proper to open the aneurismal sac, and cut it out? and in what cases is it better to leave it to the powers of nature? in short; what are the advantages and disadvantages of the different methods hitherto known for operating on aneurism? When these questions reached me, I found that I had a sufficient number of observations and facts to answer, as I thought, in an adequate manner, the whole, or the greater number of them; but a variety of circumstances prevented me from finishing and presenting my memoir in time to that illustrious Medical Society, to which I consider it a great honour to belong. Afterwards, on reflecting that the observations and facts, upon which I rested my opinion with regard to the true nature of aneurism in general, were only hinted at in that essay; and farther, that the operative part itself of external aneurism required a more extensive explanation than the narrow limits of a dissertation would allow, I changed my intention, and instead of finishing that small treatise, I undertook the present work, as it appeared to me to be necessary to young students, after the brilliant and rapid progress which this branch of surgery has made within these few years, by means of the united labours of many celebrated men, among whom Haller, Monro, Hazon, John Hunter, Home, Murray, Palletta, Deschamps, Forster, Hartley, John Bell, Maunoir, deserve particularly to be mentioned.

---

[1] Prix proposés par la Societé de Médicine de Paris dans sa première séance publique, le 27 Prairial, an. v. 15 Juin 1797.

I HAVE, for many years past, been in the habit of mentioning repeatedly to my hearers in the Clinica School, that the history of this disease was still incomplete and defective. Therefore, one of the principal objects which I have had in view, in treating of this very important subject, was that of demonstrating the insufficiency of the doctrine, which is commonly taught in the schools of surgery, with regard to the manner in which aneurism is formed, and consequently the erroneous division, adopted by writers on this subject, of aneurism into *true*, *spurious*, and *mixed*; primarily *false*, subsequently *false*; and the like. For, after a very considerable number of investigations, instituted on the bodies of those who have died of internal or external aneurisms, I have ascertained, in the most certain and unequivocal manner, that there is only one kind or form of this disease; viz. that caused by a solution of continuity or rupture of the proper coats of the artery, with effusion of blood into the surrounding cellular substance; which solution of continuity is occasioned sometimes by a wound, a steatomatous, earthy degeneration, a corroding ulcer, a rupture of the proper coats of the artery, I mean the internal and muscular, without the concurrence of a preternatural dilatation of these coats being essential to the formation of this disease; and therefore, that every aneurism, whether it be internal or external, circumscribed or diffused, is always formed by effusion.

In instituting these researches on the dead bodies of aneurismatic patients, I have employed the greatest possible care, especially in unfolding the proper coats of the injured artery; and I have paid particular attention in separating the cellular substance, and the other membranes and aponeurotic layers which cover the artery, as well as the aneurismal sac, to compare in succession, and in their natural situation, the texture and limits of all these membranous layers, in order to ascertain, with clearness and precision, what share the truly proper coats of the artery have in the formation of the sac, and what is formed by the cellular substance, which in the sound state forms a sheath to it externally, and by the other membranes and aponeuroses surrounding it. The uniform result of all these researches has been, that aneurism, in whatever part of the body it is formed, and from whatever cause it arises, is never occasioned by the dilatation, but by the rupture or ulceration of the internal and muscular coats of the artery, and consequently that these coats have not the smallest share in the formation of the aneurismal sac.

After having ascertained, in the dead subject, the constancy of this fact, I turned my attention to the examination of the most celebrated descriptions and figures which we have of aneurisms; and, from all these descriptions and figures, published by their authors as so many examples of true aneurisms, or aneurisms from dilatation, I have been induced to draw a precisely contrary conclusion; that is, that all these aneurisms had been formed by a rupture or ulceration, and none of them by a dilatation of the proper coats of the artery. Such is the power of truth, that it even shines through the darkness which, in addition to the difficulties of the investigation, authority and preconceived opinions sometimes oppose to it.

These ideas, with regard to the nature and characters of aneurism, do not, it is true, as yet point out the road to any effectual attempt for the cure of internal aneurisms, or of those which are situated beyond the reach of the hand of the surgeon; but this is not the case with regard to external aneurisms. And if, in surgery, it is generally allowed to be true, that the accurate knowledge of the nature of a disease, and of the parts which it affects, contributes very much to suggest to the surgeon the most secure, easy, and speedy method of operating for removing and curing it, the opinions which I am going to state on the subject of external aneurisms cannot fail to produce useful changes in this branch of practical surgery. For obtaining and promoting still more these advantages, I have occupied myself with investigating what is the operative process which nature, assisted by art, and sometimes even of herself alone, employs for the cure of aneurism. I have found that she performs this curative process in two ways: in the first, by means of the adhesive inflammation, and precisely in the same manner as she cures simple wounds by the first intention, the artery is converted for a certain space above and below the injury, into a perfectly solid ligamentous cord: in the second way, likewise, by means of the adhesive inflammation, she changes the soft cellular substance of the incipient aneurismal sac into a capsule, with thick firm sides, adhering strongly to the surrounding parts; within this membranous capsule a small coagulated clot of blood is formed, which being applied firmly to the lips of the wound or laceration of the artery, opposes the discharge of blood, and serves instead of a cicatrisation of the artery, the canal of which continues pervious as before the accident. Of these two kinds of cure of aneurism, however, the first only can be called truly complete and radical. According to these principles, and following the natural order of the subject, I did not find it difficult to determine the cases and circumstances in which compression may be employed as a method of cure, and when the ligature of the aneurismatic artery ought to be preferred to compression. With regard to the advantages and inconveniencies of the different methods hitherto known of operating for aneurism, the elucidation of this point seemed to me to depend, in a great measure, upon the solution of the following problem, viz. What is the degree of importance of the principal arterial trunk of a part, especially of a limb, for the preservation of the circulation and life of the limb itself? or, in other words, What is the power of the collateral vessels for supplying the functions of the principal arterial trunk of a limb, whenever the course of the blood through that trunk is interrupted in the vicinity of, as well as at a considerable distance above, the seat of the aneurism? For the more accurate solution of this problem, I have found it necessary and useful to repeat the observations relative to the arterial system of the superior and inferior extremities, both with regard to the large trunks, the collateral branches, and their principal anastomoses.

We are indebted to Haller for much important knowledge on the subject of the anastomoses of the arteries of the superior and inferior extremities; which knowledge has contributed very much to encourage the timid and doubtful minds of modern surgeons, to place more hope than our predecessors in the number and activity of the collateral vessels, and of their anastomoses, for the preservation of the circulation and life of a limb, after the ligature of its principal arterial trunk. Murray has resumed the same subject, in that part which regards the arteries of the lower extremities, from the pelvis to the knee; but if I may express freely what I feel on this point, the tables of the arteries of the extremities published by Haller, as well as those of Murray, on account of their smallness, their insulated state, and the separation of the arteries from the other parts contiguous to them, are not sufficient to place this important subject in that point of view which is necessary for producing in the readers the effect that is desired, and for impressing on the minds of surgeons that degree of conviction which is necessary for persuading them completely that these collateral branches and anastomoses are sufficient to supply the want of the principal arterial trunk, and preserve the circulation and life of the parts situated below the ligature. In Haller's tables, as well as in those of Murray, there is not that combination of facts and circumstances, as it is usually termed, which is required for a complete demonstration of the very important subject of which we are treating. For, with regard to the arteries of the lower extremities, neither is the number of the arteries of the pelvis, and of their anastomoses with the femoral artery, sufficient, nor are their position and ramifications well expressed. And with regard to the arteries of the superior extremities, there is wanting in the tables published by Haller a figure representing distinctly that combination of the communications of the arteries of the neck with those of the arm, without which communications it is impossible at one view to make young students understand, and to give an account of the considerable anastomoses existing between the arteries of the neck and of the superior arteries of the scapula with the inferior scapulars, and between these and the arteries of the humerus and arm. Besides, in the tables above quoted, the anastomoses themselves, on account of the smallness of the figures, appear too minute; not very pervious, and uncertain, and rather calculated to perpetuate in less informed surgeons, in similar cases, the language of timidity and doubt, than that of courage and confidence, founded upon anatomy and the provident resources of nature. Kirkland[b] on this subject says: 'Indeed I am fearful wrong conclusions,

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[b] Thoughts on Amputation.

'drawn from anatomy, have here (as in other in- 'stances) led us out of the way. For, from seeing 'the distribution of the arteries when filled with wax, 'it has been supposed the circulation of the blood 'could not be carried on in the parts below, where 'the passage of the blood through the main trunk 'was stopped. Even Mr. Cheselden was so biassed 'by this theory, that he could not believe the sur- 'geon who told him that he had tied up the humeral 'artery in the middle of the arm with complete suc- 'cess.' Certainly whoever regulated his opinion according to coarse injections of the limbs, would never be induced to suppose that there existed in nature a sufficiently considerable number of collateral vessels and anastomoses for carrying on the circulation, and preserving the life, in the parts below the ligature of the large arterial trunk of an extremity. But fine and fluid injections, and the careful inspection of the minute arteries of the extremities when injected, shew clearly not only the existence, but the multiplicity and extent of these arterial communications through the whole length of each limb; and anatomy, therefore, instead of leading surgeons on this point out of the way, even furnishes them with one of the strongest arguments to prove the possibility of this wonderful phenomenon, and the mechanism by which it is effected. I have therefore thought it proper to supply this defect, by substituting, instead of Haller's and Murray's plates, as far as regards the theory and practice of the operation for aneurism of the superior and inferior extremities, some other plates, copied not from the dead bodies of children, as they have done, but from adult subjects, preserving as much as possible the situation, course, and natural size of the principal arteries, of their collateral branches and anastomoses, and at the same time the respective position of the muscles between which these arteries run.

THIS anatomical labour has been followed by several experiments made in the dead body by means of very fluid injections, after having tied the trunk of the femoral and brachial arteries at different distances from their origin, with the view of proving, notwithstanding the ligature of the principal channel, the possibility of the passage of the blood by the collateral vessels from one extremity of a limb to the other. These experiments, which had been also made previously by skilful anatomists and surgeons, along with the many observations in the living body which we are now in possession of, with regard to the preservation of the inferior and superior extremities after the ligature of their principal arterial trunk, even very near to its origin, will, I hope, suffice to dissipate completely any remains of perplexity, or any kind of difficulty, which might have been entertained with regard to the surprising power which the collateral vessels and anastomoses have in carrying on the circulation, and preserving the life of the limb, below the ligature of the principal arterial trunk of the leg or arm.

THE results of these experiments, conjoined with the perfect knowledge which we are now in possession of with regard to the nature and proximate cause of aneurism, and the different degrees of resistance which the coagulated layers contained in the aneurismal sac oppose to the current of the blood within it, point out to me, in the clearest and most precise manner, in what circumstances it is proper to apply two ligatures, and when the application of one ligature only to the trunk of the artery, even at a great distance above the aneurism, may be sufficient to effect the radical cure of the disease without touching the aneurismal sac, or evacuating the clots of blood with which it is filled, or, in other words, by leaving entirely the absorption and disappearance of the grumous blood, and at the same time also the aneurismal sac, to the powers of nature. The degree of our knowledge at present with regard to the widely-extended sphere of activity of the absorbent lymphatic system, accounts for the numerous facts which may be mentioned of this kind of absorption, and at the same time shews with how great confidence this part of the cure of external aneurism may be entrusted to the powers of nature alone.

LED therefore, naturally, by the subject itself, which I propose to treat of, I have proceeded to give minute details of the operation for aneurism in the ham, of that in the thigh, and in the groin; then of that in the bend of the arm, along the humerus;

and lastly, that in the axilla. I have pointed out the great advantages derived from the Hunterian or Anellian method of operating, both on account of the facility of the execution on the part of the surgeon, as well as the safety and diminution of the pain on the part of the patient; in doing which, I have not, however, omitted to explain the particular circumstances in which the old method of operating, or that of the incision of the aneurismal sac, and the double ligature, is sometimes preferable to the modern, in which one ligature only is applied to the artery above the seat of the tumour, leaving the aneurismal sac entirely untouched.

My attention has been particularly directed to the subject of secondary hemorrhage, which is deservedly so much dreaded by surgeons, after the ligature of the great arteries in general, and in particular after the operation for aneurism. I have found, that, in order to avoid this formidable accident, it is necessary, in the first place, that the ligature be applied to the denuded artery, stripped of every part, and even of the pulpy cellular substance surrounding it; in the second place, that the pressure applied to it by means of the ligature bring the two opposite sides into firm contact, without constricting them circularly; and in the third place, that the ulcerative process of the portion of artery tied do not precede the adhesive process. For obtaining all these advantages, I have pointed out the advantage of the method which practice has taught me to be the most effectual.

To the plates of the arteries of the extremities I have added some others, representing aneurisms of the arch of the aorta, of the thoracic trunk of that artery, of the carotid, popliteal, femoral, and brachial arteries. I have done so in order to demonstrate to my readers what I have explained with regard to the true nature and character of aneurism in general, as likewise the better to point out to them the plan which I have followed in the examination of this kind of disease in the arterial system.

In the last place, I have related some histories of aneurism of the superior and inferior extremities, among which there is the very rare case of an aneurism that had appeared on the spine of the tibia, a little below the knee. The account of the greater part of these cases is intended not only to increase the number of the facts proving the utility of the Hunterian method for the radical cure of aneurism, but likewise to illustrate several points of practice which I have explained in the course of this work, as well as to make known some peculiarities that have occurred to me in the treatment of this disease. Upon which subject I think it proper to state, for the benefit of those who are not as yet well informed in such discussions, that the well-founded confidence in the propriety and utility of the Hunterian method, in opposition to the opinion of Mr. Bromfield,[c] has been at the present day carried so far, that Mr. Home, one of the most celebrated of Mr. Hunter's pupils, and one of the most zealous promoters of this method, did not hesitate to operate for an aneurism situated in both hams in the same patient, at the interval only of a fortnight between each operation; which attempt was attended with the most complete success.[d]

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[c] Chirurg. Observ. and Cases, vol. i, pag. 306. 'From observing,' says he, 'that, after the operation for aneurism in the

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bend of the arm, the collateral vessels have become dilated sufficiently to carry on the circulation, and preserve the life of the subjacent limb, the most extravagant propositions have been by some suggested, viz. that the tying of the principal trunks of the arteries of any of the extremities when wounded, may be done with a fair prospect of preserving the limb. I once,' he adds, 'saw an attempt of this kind made in a case of aneurism situated in the cavity of the ham, on which experiment I shall make no further remark than that the patient died. And I dare believe, that the embarrassments which occurred, as well as the accidents in the operation, will deter the operator from making a second attempt, should a similar case offer for his assistance.'

If Bromfield, in using these expressions, did not mean to speak of the common method of operating for the aneurism in the ham, but of the ligature of the superficial femoral artery, it is fortunate for mankind that his authority had not such weight as to dissuade Mr. Hunter, and after him other celebrated surgeons, from so important and useful an attempt, as that of the ligature of the principal artery of a limb, in a case of a wound or aneurism.

[d] Transactions of a Society for the Improvement of Medical and Chirurgical Knowledge, vol. ii, page 235.

CONTENTS.

CHAP. I. *Of the Femoral and Popliteal Arteries*........1
II. *Corollaries*..................................19
III. *Of the Arteries of the Scapula and Arm*.....27
IV. *Corollaries*..................................44
V. *Of Aneurism in general: and in particular, of the Aneurism at the curvature, and in the trunk of the Thoracic and Abdominal Aorta*.53
VI. *Of the Aneurism of the Popliteal and Femoral Arteries*.................................114
VII. *Of the Aneurism of the Brachial Artery*....160
VIII. *Of the Cure of Aneurism in general*.......188
IX. *Of the Cure of the Popliteal Aneurism*.....227
X. *Of the Cure of the Femoral Aneurism*......292
XI. *Of the Cure of the Brachial Aneurism*.....331
XII. *Of the Aneurismal Varix*..................384

CASE I. *Popliteal Aneurism*.......................404
II. *Popliteal Aneurism of long standing, and of extraordinary size*.......................408
III. *Aneurism situated in the lower part of the ham, and in the upper part of the calf of the Leg*.412
IV. *Popliteal Aneurism*.......................418
V. *Aneurism in the top of the Thigh*............421

Case VI. *Femoral Aneurism*........................426

VII. *Aneurism in the bend of the Arm*..........429

VIII. *Wound of the Humeral Artery*............432

IX. *Corrosion of the Humeral Artery, occasioned by gangrene in the bend of the Arm*.....436

X. *Singular case of Aneurism situated on the spine of the Tibia, in the vicinity of the knee*....439

Appendix..............................447

A
TREATISE
ON THE
ANATOMY, PATHOLOGY,
AND
SURGICAL TREATMENT,
OF
ANEURISM.

CHAPTER I.

OF THE FEMORAL AND POPLITEAL ARTERIES.

THE *anterior* or *external* iliac, a little before it passes out of the pelvis under the crural arch, gives off the epigastric artery, which ascends obliquely from without, forwards and upwards, towards the lower extremity of the rectus muscle of the abdomen. In the male, as it passes near to the crural arch, it gives off, to the spermatic cord, a branch which anastomoses with the spermatic artery, and is dispersed on the cremaster muscle, and on the vaginal coat of the testicle. The epigastric then ascends behind the rectus muscle, having previously, in some cases, given off the obturator artery. Several small branches of the epigastric artery, go to the integuments of the abdomen, and to the sheath of the rectus muscle; and several others sink into the other muscles of the abdomen, as well as into the rectus. Among these, a large branch ascends along the internal margin of the rectus muscle to anastomose with the mammary artery; it also communicates successively with the thoracic and intercostal arteries. The proper trunk of the epigastric artery keeps behind the rectus muscle, and as it ascends, it increases remarkably the number of the inosculations with the mammary, thoracic, and intercostal arteries.

§ 2. Oppoſite to the origin of the epigastric artery, or a little lower, the *anterior* iliac gives off the abdominal artery. This artery[a] takes a retrograde course between the abdominal muscles, directing itself towards the spine of the os ilium. It supplies, in the first place, branches to the inguinal glands, to the iliacus internus muscle, to the beginning of the sartorius, and it anastomoses with the cutaneous inguinal branch of the posterior or *profunda femoral* artery. The abdominal artery then ascends between the *internal* oblique, and transverſalis abdominis muscles, following the curvature of the spine of the os ilium, as far as the eighth rib. During the whole of this course, it gives branches to the muscles of the abdomen, to the psoas, to the iliacus internus, and to the anterior crural nerve, and terminates in repeated anastomoses with the ileo-lumbar, with the lumbar, with the intercostal, and with the thoracic arteries.

§ 3. The *anterior* iliac artery, as it passes out of the abdomen, under the crural arch, receives the name of *femoral* artery. This large artery, in its course from the crural arch to its first division, runs in a triangular cavity formed by the convergence of the iliacus internus, psoas, and pectineus muscles;

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[a] Some anatomists call this artery the lesser external iliac, others the circumflex of the ilium.

it passes over the femoral vein, which lies over it above the crural arch, and it rests upon a layer of dense cellular substance, which fills up this triangular cavity. On the fore part the femoral artery is covered by the aponeurosis of the muscle of the fascia-lata, by some inguinal glands, and by the common integuments. The femoral artery, at the distance of one inch, or one and a half, very rarely two inches, below the crural arch, in a well-formed adult, of the ordinary stature, divides into two principal branches, the *superficial* and *profunda* femoral arteries.

§ 4. The *superficial* femoral artery gives off, in the first place, the *superior external* pudic artery. This artery, situated a little below the common integuments, crosses the heads of the pectineus and gracilis muscles; it then gives branches to the inguinal glands, to the scrotum, to the fat about the pubis, and lastly, anastomoses with some ramifications of the epigastric artery.

§ 5. At a short distance below the origin of the *superior external* pudic artery, the *superficial* femoral gives off the *inferior external* pudic artery, which, in the same manner as the *superior*, passes across on the heads of the pectineus, adductor *longus* femoris and gracilis muscles, and then is reflected upon the skin of the scrotum, and on the integuments of the penis, along which it extends as far as the prepuce. This artery gives off several branches to the cellular membrane, to the integuments of the abdomen, and to the inguinal glands, and anastomoses in different places with the arteries of the penis, arising from the *common* pudic artery, which is a considerable branch of the ischiatic artery. Besides the two external pudic arteries, a third is not unfrequently found, which, in the subject from which the drawing was taken, arose from the internal circumflex artery.

§ 6. The trunk of the *superficial* femoral artery, after giving off the two *external* pudic arteries, descends obliquely from without, towards the inner side of the thigh, and sinks gradually deeper in the cellular substance, as it passes down the thigh, within the triangular space left by the adductor *secundus* and vastus *internus* muscles. Towards the middle of the thigh, the trunk of the *superficial* femoral artery is situated very deep in the triangular space between these two muscles; but this arterial trunk is likewise crossed and covered by the sartorius muscle, so that the pulsation of the *superficial* femoral artery, can only be felt in the adult, by pressing strongly with the finger at that place.

§ 7. The branches given off by the *superficial* femoral artery, below the origin of the *inferior external* pudic, are nearly the following. Some arteries going to the sartorius muscle; some to the cruralis and to the vastus *internus;* some to the gracilis and semimembranosus muscles. Those arteries which go to the vastus *internus*, are of considerable size, and, therefore, after having ramified within that muscle, they anastomose in the lower part of the thigh, with some ramifications of the *profunda* femoral artery, with the *great* anastomotic branch of the popliteal artery, and with the articular arteries of the knee. Of the arteries passing into the sartorius, gracilis, and semimembranosus muscles, some are distributed within these muscles, and others having passed through their substance, are dispersed on the integuments of the inner side of the thigh.

§ 8. The *superficial* femoral artery, having reached the lower third of the thigh, passes through the adductor *magnus* from before, backwards in the space between the vastus *internus* and the beginning of the tendon of the long portion of the adductor *magnus* muscle. From that place, the *superficial* femoral artery descends posteriorly into the cavity of the ham, where it is surrounded and covered by a large quantity of cellular substance and fat, together with the vein and the great sciatic popliteal nerve, which lies over it, and it is protected on each side by the tendons of the flexor muscles of the leg.

§ 9. A little before it passes through the adductor *magnus* muscle, and therefore, before it descends into the cavity of the ham, the *superficial* femoral artery gives off a large branch, to which Murray[b] has given the name of *inferior perforant* of the *superficial* femoral. This artery runs posteriorly in a transverse direction, to the lower and back part of the thigh, concealed in a great measure by the fibres of the adductor *magnus* muscle, and by the short head of the biceps cruris, to which it gives a branch. Another branch proceeding from the same artery, enters the lower and posterior part of the femur, and constitutes the *inferior nutritious* artery of that bone. From thence the *inferior perforant* artery of the *superficial* femoral is concealed in the substance of the vastus *externus* muscle, within which it gives off numerous branches, and then in the vicinity of the knee, it anastomoses with the

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[b] In Aneurysmata femoris observat. fig. iii, *t. w.*

superior external articular, and with the *external* circumflex artery, a considerable branch of the *profunda* femoral. Farther, some branches of the *inferior perforant* artery of the *superficial* femoral, sink into the lower portion of the adductor *magnus*, into the semitendinosus, semimembranosus, and into the short head of the biceps cruris.

§ 10. The *superficial* femoral artery, as soon as it enters the cavity of the ham, receives the name of popliteal artery. The first branches which go off from the popliteal artery, are the *great* anastomotic,[e] and the *superior internal* articular artery of the knee.

§ 11. The *great* anastomotic artery, from the cavity of the ham, ascends towards the inner, lower, and fore part of the thigh, covered by the fibres of the vastus *internus*, and after making several serpentine turns, sinks into that muscle. This artery, subdivided into many branches, is distributed partly to the fibrous bundles of the vastus *internus* muscle, and partly anastomoses with the branches already described, which are given off by the *superficial* femoral, to the upper part of that muscle. Farther, the *great* anastomotic communicates with the ramifications of the *external* circumflex, a branch of the *profunda* femoral, and with branches of the *superior internal* articular artery.

§ 12. The *superior internal* articular artery, given off by the popliteal, descends towards the internal condyle of the femur, between the tendon of the long portion of the adductor *magnus* of the thigh, and the vastus *internus*. Having reached the vicinity of the internal condyle of the femur, it sends off the artery of the periosteum, and, at the same time, the artery of the spongy bony substance of that condyle. This artery, after having made several anastomoses with the superior arteries of the periosteum of the thigh-bone, with the *superior external* articular, with the *great* anastomotic, and with the *superior internal* articular artery, is covered by the common tendon of the extensor muscles of the leg, and at last enters the spongy bony substance of the internal condyle of the femur. The *superior internal* articular artery then divides into two branches, the *superficial* and the *profunda*. The latter branch of the *superior internal* articular artery, having passed beyond the capsular ligament of the knee, rests upon the periosteum covering the lateral surface of the internal condyle of the thigh-bone, and having reached the margin of the internal condyle, where it begins to be covered by cartilage, it divides into numerous minute branches, which penetrate by as many small holes, into the spongy bony substance of the internal condyle of the femur. The *superficial* branch of the *superior internal* articular artery extends upon the capsular ligament of the knee, assists in forming a beautiful vascular net-work on the inner side of the knee, spread over the patella, and anastomoses in several places with the *deep* branch of the *superior internal* articular artery, with the *great* anastomotic and with the articular arteries of the opposite side of the knee. A considerable branch of this artery runs on the edge of the internal *semilunar* cartilage, then passes under the patella, and enters the cavity of the knee-joint. There are several branches of the *superior internal* articular artery, which we ought not to omit mentioning, distributed upon the sheath of the tendons of the flexor muscles of the leg, and from thence forming arches of communication between the *superior* and *inferior* articular arteries of the knee. It is likewise proper to remark, that in some subjects, a second *superior internal* articular artery is met with, but when it does exist, it is much smaller than the first; it is sometimes distributed wholly to the periosteum covering the posterior and lower surface of the thigh-bone, and to the sheaths of the semimembranosus, seminervosus, and sartorius muscles; and sometimes it runs on the inner side of the knee, and joins the vascular plexus formed by the *superior* and *inferior* articular arteries.

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[e] Murray, loc. citat. fig. i, w.

§ 13. The *inferior internal* articular artery arises from the popliteal artery, low down in the cavity of the ham, and frequently, by a common trunk, with the arteries proper to the muscles of the calf of the leg. The *inferior internal* articular artery runs obliquely from above, downwards, and from behind, forwards, between the gastrocnemius and popliteus muscles. It ascends on the head of the tuberosity of the tibia, covered by the tendons of the semimembranosus, seminervosus, and sartorius muscles, as well as by the internal lateral ligament of the knee. There, after having given small twigs to the popliteus muscle, to the posterior *crucial* ligament, and to the *capsular* ligament, the *inferior internal* articular artery is reflected from below, upwards upon the tibia, and forms a vascular plexus, which extends a good way on the ligament of the patella, and upon the patella itself, anastomosing in several places with the *superior internal* articular artery, and with the articular arteries of the opposite side, or the *external* arteries of the knee.

§ 14. The *superior external* articular artery arises from the outer side of the popliteal artery; it ascends above the outer condyle of the femur, and furnishes branches to the periosteum covering the lower and back part of that bone; and also, to the sheath of the tendon of the biceps cruris muscle, to the articular capsule of the knee, to the plantaris, and to the outer head of the gastrocnemius muscle. Having passed the insertion of the biceps cruris muscle, the *superior external* articular artery divides into a *deep* and *superficial* branch. The *deep* branch having given some twigs to the vastus *externus*, is spread in numerous twigs on the periosteum covering the lower and lateral outer extremity of the femur; some of these twigs communicate with the superior arteries of the periosteum of that bone, and especially with that which penetrates its internal condyle. The *deep* branch then ramifies on the periosteum covering the external surface of that condyle, and upon the external lateral ligaments of the knee; and when it reaches the place where the external condyle begins to be covered with cartilage, it divides into numerous small branches, each of which enters into the spongy bony substance of that condyle. The *superficial* branch of the *superior external* articular artery passes over the common tendon of the extensor muscles of the knee, and distributing several branches above and below the patella, anastomoses with the *external* circumflex artery, with the perforating, and with the articular arteries of the opposite or inner side of the knee.

§ 15. The *inferior external* articular artery derives its origin from the outer side of the popliteal artery, immediately below the articulation of the femur with the tibia. This artery, covered by the plantaris and gastrocnemius muscles, and also by the external lateral ligaments of the knee, ascends and appears on the outer side of the knee, a little above the head of the fibula. From thence it runs along the *semilunar* cartilage of the same side, as far as the patella, sending small branches within the articulation of the knee, and lastly, anastomoses with the *superior external* articular artery, with the *superior internal* articular under the ligament of the patella, and with the *recurrent tibial* articular artery.

§ 16. The *middle* articular artery, called by Haller *azyga*, presents many varieties with respect to its origin. For it sometimes arises from the posterior surface of the popliteal artery, sometimes it is only a branch of the *superior internal* articular artery, sometimes it comes off from the *superior external* articular artery. In whatever way the *middle* articular artery arises, after a short space, it sinks posteriorly into the ham in the hollow between the condyles of the os femoris; it ramifies upon the *crucial* ligaments, upon the *semilunar* cartilages, and within the knee it anastomoses with those branches of the articular arteries which dip into the cavity of the joint, as has been decribed above.

§ 17. The *recurrent tibial* articular artery arises from the *anterior* tibial, a little after it has passed through the interosseous ligament, ascends from below upwards, and comes out at the knee through the head of the tibialis *anterior* muscle. It is ramified upon the periosteum of the tibia, and anastomoses with the *external* articular arteries which are nearest to it, and likewise unites with the *internal* articular arteries of the knee, by means of the communication which the *recurrent tibial* articular artery has with the vascular plexus spread over the patella.

§ 18. The popliteal artery, after giving off the articular arteries of the knee, supplies on both sides considerable branches to the muscles of the calf of the leg, viz. the popliteus, plantaris, soleus, and gastrocnemius; some of these branches likewise are ramified on the periosteum of the tibia, on the large popliteal nerve, on the posterior surface of the articular capsule of the knee, and on the tendons of the flexor muscles of the leg; others descend superficially and immediately under the skin of the calf of the leg, and extend as far as the foot, following the direction of the tendo-achillis. After this, the popliteal artery deep under the muscles, divides into the *anterior* and *posterior* tibial arteries. Thus far of the *superficial* femoral: we now proceed to trace the *profunda* femoral artery.

§ 19. The *profunda* femoral, situated behind the *superficial* femoral artery descends in the triangular fossa formed by the convergence of the iliacus *internus* and pectineus muscles, at its beginning from the inner towards the outer part of the thigh, then in a contrary direction from the outer towards the inner part of the limb. It then dips down considerably in the space between the vastus *internus* and adductor *magnus* muscles of the thigh.

§ 20. The *profunda* femoral artery, a little after its origin, sends off the *external cutaneous* branch of the thigh; this branch, after being distributed upon the iliacus internus muscle; upon the head of the rectus femoris; upon the sartorius muscle, and after various anastomoses with the abdominal artery, pierces the aponeurosis of the muscle of the fascia lata, near the spine of the os ilium, and is distributed on the skin covering the hip. Another branch arising from the trunk of the *profunda* femoral artery, is distributed upon the sartorius muscle, and on the skin covering it.

§ 21. The most considerable branches which arise from the *profunda* femoral artery, immediately after its origin are the circumflex arteries of the thigh, viz. the *internal* and *external* circumflex arteries. The *internal* circumflex artery runs across under the trunk of the *superficial* femoral, and sinks deep in the space left by the pectineus, iliacus internus, and psoas muscles. It then runs round behind the neck of the femur, and proceeds in the hollow which lies between the *lesser* and *great* trochanter. The first branch which goes off from the *internal* circumflex artery, is that which sinks into the iliacus internus and psoas muscles, and anastomoses with the *cutaneous* branch of the *profunda* femoral artery. From the convexity of the *internal* circumflex, arises in the first place the *external pudic* branch, which, after having given some small twigs to the pectineus muscle, and and to the superior portion of the adductor *secundus*, is dispersed on the integuments round the pubes, and on the root of the scrotum; in the next place the branch which forms the anastomosis between the *internal* circumflex and obturator arteries, and lastly, in succession, those twigs which go to the *external* obturator muscle, and to the ligamentous capsule of the articulating head of the femur with the ilium, Nearly from the same convexity of the *internal* circumflex artery, arise the branches which sink into the pectineus, gracilis, adductor *primus* and *secundus* muscles, and supply the skin adjoining these parts; some of these anastomose with the *external pudic* branches of the *superficial* femoral artery. The *internal* circumflex artery then bends very much behind the *lesser* trochanter. It divides there into two branches, one of which subdivided into smaller ones, dips into the flesh of the superior portion of the adductor *magnus* muscle of the thigh; the other is hid behind the *lesser* trochanter, and assumes the name of *posterior* trochanteric artery. This artery, having formed some anastomoses with the obturator artery, runs under the neck of the femur in the hollow situated between the *great* and *lesser* trochanter, and having reached posteriorly the vicinity of the inferior edge of the quadratus femoris muscle, it divides into two branches, one of which from the direction they take, is called *ascending*, the other *descending*. The *ascending* branch goes up towards the great trochanter, and after having given branches to the *quadratus* femoris, to the gemelli, and obturator *internus* muscles, and to the articular capsule of the head of the femur, anastomoses with a branch of the ischiatic artery; then with the *deep common* pudic artery, with the trochanteric branch of the external circumflex, and with the trochanteric branch of the *first* perforating artery. The *descending* branch of the *internal* circumflex artery comes out from under the edge of the *quadratus* femoris muscle, or between this muscle and the head of the adductor *magnus* of the thigh, and then dividing into several small branches, forms a considerable anastomosis with the ischiatic artery, and is finally distributed upon the long head of the biceps cruris, on the semimembranosus, seminervosus, and adductor *magnus* muscles.

§ 22. The *external* circumflex artery arises from the *profunda* femoral artery, sometimes at the distance of an inch, sometimes of an inch and an half below the origin of the *internal* circumflex, near to the insertion of the iliacus internus muscle. This large artery takes an oblique direction from within, to the outer part of the thigh, and is covered by the sartorius, rectus, vastus externus, and fascia lata muscles. A little after its origin, the *external* circumflex artery divides into several branches, some of which may be called *transverse*, others *descending*. One of the *transverse* branches having run some way behind the rectus muscle of the thigh, to which it gives a few branches, sinks into the muscle of the fascia lata, and having passed through the aponeurotic sheath of this muscle, it goes with some other branches to the skin of the top of the thigh, and from thence along the spine of the os ilium to the gluteus *minor*. Other *transverse* branches are distributed partly to the iliacus internus muscle, and partly to the articular capsule of the head of the thigh-bone; in this part they anastomose repeatedly with the branches proceeding from the *internal* circumflex and obturator arteries. One of the most considerable of the *transverse* branches of the *external* circumflex, is the *anterior* trochanteric artery, which, after having given some branches to the superior part of the cruralis muscle, to the articular capsule of the head of the femur, and to the spungy substance of that bone, pierces the head of the vastus *externus* muscle, and runs on the back of the great trochanter, where it forms a beautiful vascular plexus, by means of which the *anterior* trochanteric artery anastomoses with the *posterior* trochanteric of the *internal* circumflex, with the branch of the *deep* com-

mon pudic artery, and with the trochanteric branch of the *first* perforating artery.

§ 23. Among the *descending* branches of the *external* circumflex artery may be mentioned, those which enter the cruralis, the vastus *internus*, and the rectus muscle of the thigh. Some of these last branches having passed through the rectus muscle, are distributed anteriorly on the skin of the thigh; others extend as far as the patella, where they anastomose with the *superior* articular arteries of the knee, arising from the popliteal artery. From both of these *descending* branches of the *external* circumflex, the thigh-bone receives small *nutritious* arteries. The principal *descending* trunk of the *external* circumflex artery runs on the outer side of the thigh, between the vastus *externus* and cruralis muscles; to which muscles, especially to the vastus *externus*, it furnishes many branches; it then extends down to the knee, where it evidently anastomoses with the perforating arteries of the *profunda* femoris; with the perforant of the *superficial* femoral, and with the *superior* articular arteries of the knee.

§ 24. The *profunda* femoral artery, after having given off the circumflex arteries, bends from the outer towards the inner side of the thigh, and descends very deep in the triangular space left by the vastus *internus* and adductor *secundus* muscles. The most considerable branches which come off from this lower curvature of the *profunda*, besides those which it furnishes to the gracilis and adductor muscles, are the arteries called perforating, distinguished from each other by the names *first*, *second*, *third*, and *fourth* perforating arteries. The last perforating artery, however, is only, properly speaking, the continuation or extremity of the trunk of the *profunda.*

§ 25. The *first* perforating artery pierces the thigh from before, backwards, in the space between the insertion of the pectineus muscle and the adductor *brevis* and vastus *internus*, and appears posteriorly at the distance of about two inches and a half below the *quadratus* femoris muscle. After having given some small branches to the muscles in the neighbourhood of which, or through which it passes, and especially having furnished the *superior nutritious* artery of the femur, the *first* perforating artery divides into two principal branches, one of which is called the trochanteric, the other the transverse. The trochanteric branch of the *first* perforant, is distributed on the *great* gluteal muscle, within the substance of which it anastomoses with the ramifications of the posterior iliac artery; it then ascends along the *great* trochanter, and anastomoses in several ways and directions with the other trochanteric arteries of different origins, such as those arising from the two circumflex arteries, and with the *common* pudic artery. The *transverse* branch of the *first* perforant having sent several small branches through the aponeurosis of the muscle of the fascia lata, as far as the skin, is concealed in the substance of the vastus externus muscle, within which it anastomoses with the ramifications of the *external* circumflex, and with those of the inferior perforating arteries. In the subjects in which the descending branch of the *internal* circumflex does not furnish a sufficient number of branches to the heads of the flexors of the leg, these muscles receive them from the *first* perforating artery.

§ 26. The *second* perforating artery is reflected from before to the back part of the thigh, piercing the adductor *magnus* muscle in the space between the adductor *primus* and *secundus*. Having passed through the adductor *magnus* muscle, to which it gives some branches, the *second* perforating artery subdivides into several branches, which dip into the long head of the biceps flexor cruris, into the semimembranosus and seminervosus muscles. In some subjects, this artery forms a communication with the trochanteric and transverse branches of the *first* perforating artery.

§ 27. The *third* perforating artery is reflected from before, to the posterior part of the thigh, crossing the aponeurotic insertion of the adductor *secundus* muscle, and, at the same time, the fibres of the adductor *magnus*. This artery runs over the upper part of the short head of the biceps flexor cruris, and from thence penetrates the substance of the vastus *externus*; and within that muscle it anastomoses with the *transverse* branch of the *first* perforant, with those of the great *descending* branch of the *external* circumflex artery, and with the perforant of the *superficial* femoral.

§ 28. The *fourth* perforating artery, the continuation or extremity of the trunk of the *profunda* femoral artery, divides into several branches, which run into the long and short portions of the biceps flexor cruris, and then into the semitendinosus, semimembranosus, and into the lower extremity of the adductor *magnus* femoris.

§ 29. It is necessary to state, that the *third* perforating artery, and the *transverse* branch of the *first*, after being minutely distributed through the muscular substance of the vastus *externus*, anastomose repeatedly with each other, and with the *descending* branch of the *external* circumflex artery, and that, in the vicinity of the patella and on the top of the knee, these arteries communicate with the perforant of the *superficial* femoral, and with the *superior* articular arteries which arise from the popliteal artery.

§ 30. The anastomoses and communications between the arteries of the periosteum of the femur, and the *superior* articular arteries of the knee, form likewise an object of consideration, both to the anatomist and to the surgeon. From the branch of the *external* circumflex, which enters the cruralis muscle, are sent off smaller branches, which are dispersed on the periosteum of the anterior and internal surface of the head of the thigh bone; round which place they form an extensive vascular plexus, intermixed with other arterial twigs coming from under the vastus *externus* muscle. Nearly about the middle of the thigh-bone, the *profunda* furnishes a considerable arterial branch to the periosteum, which separating into branches, upwards and downwards, along the bone, increases considerably this vascular net-work of the periosteum, and keeps up, by its numerous inosculations, an easy and abundant communication, both with the superior arterial branches of the periosteum coming from the *external* circumflex artery, and with those derived from the arteries situated on the posterior surface of the bone under the vastus *externus* muscle. This vascular plexus, distributed abundantly on the periosteum of the femur, at last, in the neighbourhood of the knee, forms repeated and distinct anastomoses with the popliteal artery, by means of the branch which it gives to the periosteum covering the bone in the vicinity of the condyles, and likewise by means of the *superior* articular arteries of the knee.

CHAPTER II.

COROLLARIES.

§ 1. All the anastomoses described in the preceding chapter, as well as all those numerous communications which, on account of the smallness of the arterial vessels by which they are formed, I have omitted to mention particularly, are naturally distinguished into two orders; the one, including those anastomoses which take place between the arteries of the parietes of the abdomen and thorax, and of the inside of the pelvis with the *common* femoral artery; and the other, those which occur between the *superficial* and *profunda* femoral arteries along the thigh, and over the whole circumference of the knee.

§ 2. With regard to the first order of anastomoses, or that between the arteries of the trunk of the body, and the arteries of the lower extremities; if, from any cause whatever, the passage of the blood through the *external* iliac artery be impeded or wholly obstructed in that portion lying between the origin of the *internal* iliac artery and the crural arch, the blood of the aorta will not fail to find other ways of passing from the trunk of the great artery into the *superficial* and *profunda* femoral arteries. For the epigastric artery, by its position, by its size, and by its anastomoses, is capable of conveying the blood to the *common* femoral artery, as it is about to come out from under the crural arch, from the *internal* mammary, from the intercostal, and from the thoracic arteries, by means of the numerous communications which the epigastric artery has with those of the thorax.[a] The same derivation is caused by the abdominal artery, in similar circumstances; for, by the medium of its repeated anastomoses with the ramifications of the ileo-lumbar, of the lumbar, and of the inferior intercostal arteries,[b] it may, as well as the epigastric, convey a considerable quantity of blood to the *common* femoral artery, from the parietes of the thorax, of the abdomen and loins, before this artery passes from under the crural arch, even although the passage of the blood within the pelvis, by the *external* iliac artery, be impeded or totally obstructed.[c]

§ 3. Immediately after passing the crural arch, the external pudic arteries, by their communications with the cutaneous branches of the epigastric artery upon the bend of the thigh, the abdomen, and upon the external parts of generation, and by means of their anastomoses with branches of the abdominal artery, and with those of the *common* pudic artery, contribute very much to increase the derivation of the blood of the aorta into the *superficial* femoral artery immediately below the crural arch.

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[a] See Haller. Fascic. Anat. vi. Tab. 1.

[b] Haller. Fascic. Anat. viii. Tab. art. tot. corp. anter.

[c] The epigastric vein may do, and has sometimes done the same in an inverted sense, or according to the current of the venous blood. The celebrated Mr. Cline having found in the body of a man the inferior vena cava obliterated a little above its bifurcation, in consequence of a steatomatous tumour, which had formed in the cellular substance behind the peritonæum, and which occupied a part of the pelvis and lumbar region, remarked that the epigastric veins were become as large as the little finger, and that the superficial veins of the abdomen, as well as the lumbar, and those of the internal cavity of the abdomen, were in a similar manner very much dilated; the internal mammary vein likewise greatly enlarged, and also the epigastric, with which it anastomosed, opened, as usual, into the superior cava, near to the origin of the subclavian veins; by which circumstance the venous blood of the lower extremities was poured into the superior cava, by means of the mammary vein, and into the inferior cava, by the lumbar veins, above the compression caused by the steatomatous tumour.

§ 4. The conspicuous anastomoses which the two circumflex arteries of the thigh make with the *internal* iliac, with the ischiatic, with the *common* pudic, and with the obturator arteries, attract, to use the expression, and greatly accelerate the current of blood from the internal part of the pelvis into the profunda *femoral* artery. For, the *internal* circumflex artery anastomoses in the first place with the *external* pudic arteries, by means of the branch which it gives to the root of the scrotum and penis; it then communicates, in the seat of the foramen ovale, with the obturator artery; and, whether this last artery comes off from the epigastric, or from the *internal* iliac, the effect is the same in respect to the transmission of the blood from the aorta into the *profunda* femoral artery, without passing through the *external* iliac; then the *internal* circumflex artery constitutes a considerable anastomosis with the ischiatic, and *common* pudic arteries, by means of the *posterior* trochanteric branch, by which means the arterial blood of the cavity of the pelvis flows into the *profunda* femoral artery, independent of any *obliteration*, or obstruction of the *external* iliac artery.

§ 5. The other route of communication of the *profunda* femoral artery with the arteries contained in the cavity of the pelvis, by means of the *external* circumflex, is equally evident, and worthy of attention. For, the *transverse* branches of this artery, those which go upwards towards the hip, upon the gluteus *medius* muscle, anastomose with the posterior iliac artery, and those which pass beyond the muscle of the fascia-lata communicate with the muscular and cutaneous arteries of the hip and side, and the *anterior* trochanteric branch anastomoses on the great trochanter with the ischiatic, with the *common* pudic artery, with the *posterior* trochanteric branch of the *internal* circumflex, and with the trochanteric branch of the first perforating artery; which last branch likewise anastomoses in several places, with the gluteal and *posterior* iliac arteries coming out of the cavity of the pelvis; therefore the blood which comes out of the pelvis to the side and hip meets the course of the two circumflex arteries of the thigh, through which it is carried to the trunk of the *profunda* femoral, even although the course of the blood through the *external* iliac artery, in the vicinity of the crural arch, be shut and obliterated. Some years ago, Dr. Baillie, physician to S^{t}. George's hospital, London, found, in the body of an adult male subject, the crural artery obliterated above the *profunda* femoral, without its having occasioned the loss of the circulation or life of the limb below. This very important observation was also made by Guattani, by Gavina, and afterwards confirmed by several other surgeons of great reputation. The explanation of this phenomenon may be clearly deduced, in my opinion, from the anastomoses just described.

§ 6. With regard to the second order of anastomoses, or those which take place between the *superficial* femoral and popliteal arteries with the *profunda*, along the course of the thigh, and round the knee; or, what signifies the same thing, between the two great femoral arteries and the popliteal, there are two routes which the blood takes, the one or other of which is more or less easy and free, according as the *superficial* femoral artery is obstructed or tied near, or at a distance from the place where the *superficial* femoral perforates the adductor *magnus* muscle of the thigh, to descend into the ham. One of these routes is by the great branches which the superficial femoral artery gives to the vastus internus muscle, and at the lower part of the thigh communicate with the great anastomotic branch of the popliteal artery. By these branches, on the *superficial* femoral artery being obstructed or tied a little before it passes through the adductor *magnus* muscle, to descend into the cavity of the ham, the blood finds a ready and easy passage, from the *superficial* femoral above the place of the ligature, into the popliteal artery, by the communication between these large branches and the *great anastomotic* branch.

§ 7. When this route is obstructed, from the ligature having been applied very high up on the *superficial* femoral artery, as in the upper third of the thigh, the passage of the blood through the trunk of the artery is supplied by the anastomoses which take place between the *profunda* and the *superficial* femoral just about to become popliteal, in particular by the anastomoses kept up by means of the *external* circumflex and the perforating arteries, with the inferior branches of the *superficial* femoral, and with the articular arteries of the knee.

§ 8. For, the smaller *descending* branches of the *external* circumflex artery, inserted into the vastus internus, cruralis, and rectus femoris muscles, anastomose at the lower part of the thigh with the *great anastomotic* branch of the popliteal artery. The great *descending* artery of the *external* circumflex, and all, or a great many of the perforating arteries of the *profunda* femoral by means of their *transverse* branches, which sink into the substance of the vastus *externus* muscle, anastomosing with each other, at last communicate with the great perforant artery of the *superficial* femoral, which last artery joins the *superficial* femoral, at the part where it passes through the adductor *magnus* muscle, to descend into the cavity of the ham. In consequence of this, the blood which runs by the *external* circumflex, and by the perforating arteries of the *profunda*, after having supplied the fibres of the above mentioned muscles, and in particular those of the vastus *externus*, is at last conveyed into the popliteal artery by the *great anastomotic*, and by the perforant of the *superficial* femoral artery.

§ 9. But, still lower, and even in the cavity of the ham, the blood enters the popliteal artery, conveyed by the branches above mentioned of the *external* circumflex, and of the perforating arteries of the *profunda* femoral, by means of the numerous anastomoses which all these arteries have with the articular arteries of the knee, and with the *recurrent* tibial articular artery. Then the branch of the *external* circumflex, which descends along the rectus muscle of the thigh, anastomoses with the *superior internal* articular artery of the knee, with which artery the *great anastomotic* of the *superficial* femoral also communicates. In a similar manner the great *descending* branch of the *external* circumflex, the *transverse* branches of the perforating arteries of the *profunda*, and the perforant of the *superficial* femoral, anastomose on the top, and round the *outer* side of the knee, with the *superior external* articular artery. The two *superior* articular arteries of the knee then communicate repeatedly with the *inferior* articular arteries, and at the same time with the *recurrent tibial* articular artery. From which it follows, that the blood of the *profunda* femoral is conveyed into the popliteal artery at the upper part of the ham, by the *great anastomotic* branch, and the perforant of the *superficial* femoral artery, and that it comes into it at the lower part of the ham, by the conspicuous anastomoses which the *profunda* femoral keeps up with the *superior* and *inferior* articular arteries of the knee.

§ 10. To all this ought to be added the communication which the *profunda* femoral has with the popliteal artery, by means of the arteries of the periosteum covering the femur. The two principal arteries of the periosteum covering the anterior and lateral inner surface of that bone, the one arising from the branch of the *external* circumflex artery, which sinks into the cruralis muscle, the other, which comes off from the trunk of the *profunda* femoral artery, after having united with many other branches of this class, which the perforating arteries spread upon the periosteum of the posterior and outer surface of the bone, form together an extensive and minute vascular net-work,[a] which extends to the lower part of the thigh-bone, and finally anastomoses with the artery which the popliteal sends to the periosteum, in the neighbourhood of the internal condyle of the femur, and communicates at the same time with the branch of the *superior* course of the clavicle. This artery furnishes cutaneous branches to the *sternal* portion of the clavicle, which anastomose with the *superior* thoracic arteries, and with the *internal* mammary; some sink into the beginning of the sterno-mastoid and sterno-hyoid muscles; others into the subclavian and serratus *magnus* muscles; others into the coraco-hyoid muscle, and into the membranes of the vena cava, of the jugular and subclavian veins; and also, into the neighbouring lymphatic glands, and into the integuments of the neck, and of the top of the shoulder. Towards that portion of the clavicle which is called *humeral*, the *superior* scapular artery divides into two branches of unequal size; the smaller of these advances under the clavicle in the fossa *supra spinata* of the scapula; where having divided into other smaller twigs, it anastomoses repeatedly with the *transverse* cervical thyroid artery, with the continuation of the trunk of the *superior* scapular, with the *humeral* thoracic, and contributes to form a beautiful vascular plexus, extending over the acromion, and on the *humeral* extremity of the clavicle. The large branch, or rather the continuation of the trunk of the *superior* scapular artery, after having anastomosed in the *fossa supraspinata* with the smaller one, and having given branches to the capsular ligament of the humerus, as also to the supra spinatus muscle, descends by the fissure beween the root of the acromion, and the neck of the scapula, and there, sometimes in one, sometimes divided into two branches, unites with the *inferior circumflex* scapular artery, and forms with it an arterial anastomotic circle, which surrounds the scapula.

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[a] Haller. Elem. Physiolog. In integro periostio humeri, femorisve nullus est ramus ad quem ex omni alio ramo ejus membranæ libera via non sit.

§ 4. The second branch of the *inferior* thyroid artery, or the *transverse thyroid* cervical artery, (transversalis colli), in its course across the lower part of the neck, gives branches to the elevator muscles of the angle of the scapula, to the *middle* and *posterior* scaleni muscles; to the acromion, and then divided into smaller twigs ascending along the neck, it sinks into the head of the trapezius, and into the splenius muscle of the head and neck, at which part this artery anastomoses with the occipital artery, and then sends down twigs to the lower portion of the trapezius, and to the muscles of the back.

§ 5. The third branch of the *inferior* thyroid artery, or the *ascending* cervical, (ascending thyroid), proceeds upwards in the neck, along the transverse processes of the cervical vertebræ, between the scaleni muscles and rectus *anterior* of the head. This artery gives branches to the sterno-mastoid, coraco-hyoid, to the *anterior* and *middle* scaleni muscles, to the levator of the angle of the scapula, to the splenius muscle of the head and neck, to the par vagum, to the *superior* cervical ganglion of the intercostal nerve, and to the lymphatic glands and integuments of the neck; it then anastomoses at the upper part with the occipital artery. The *deep* branches which go off from this artery, are distributed upon the *intertransverse* muscles of the neck, on the origins of the scaleni muscles and rectus *anterior* of the head. Others of these *deep* branches of the *ascending thyroid* cervical artery, sometimes more, sometimes less numerous, enter the vertebral canal by the same holes through which the spinal cervical nerves come out, and are distributed upon the meninges, which cover the spinal marrow of the neck. The superior branches of the *ascending* cervical artery, constitute a conspicuous and double anastomosis with the vertebral artery.

§ 6. The trunk of the left *inferior* thyroid artery, which is more particularly described here, bends behind the carotid of the same side, and from the curvature which it makes, gives off a branch which ascends on the anterior surface of the cervical vertebræ, and is distributed to the rectus *anterior* of the head, and longus muscle of the neck, to the bodies of the cervical vertebræ, and to the *middle* cervical ganglion of the intercostal nerve; then this branch, divided into other smaller ones, enters by the lower holes between the vertebræ of the neck, into the vertebral canal, and in these places anastomoses with the *deep* branches of the *ascending thyroid* cervical artery above described, and with those of the *descending* pharyngeal artery.

§ 7. The trunk, properly so called, of the *inferior* thyroid artery, is reflected from without, to the inner part of the neck, towards the gland of the same name, in which it anastomoses very frequently with the branches of the *superior* thyroid artery. It likewise gives many branches to the larynx, to the trachea, to the broncheal glands, and to the œsophagus.

§ 8. The subclavian artery bending from within the chest outwards, runs between the *anterior* and *middle* scaleni muscles. Having passed beyond these muscles, the subclavian artery inclining from above downwards on the first rib, gives off the *profunda* cervical artery, which having given several branches to the scaleni muscles, and to the levator of the angle of the scapula, divides into two branches of unequal size, one of which is the *posterior ascending* cervical, the other the dorsal artery of the scapula.

§ 9. The *posterior ascending* cervical branch of the *profunda* subclavian cervical artery, after being distributed on the levator of the angle of the scapula, and under it to the serratus *superior posticus*, perforates the levator muscle; it then ascends on the posterior surface of the neck, and sinks into the head of the splenius muscle of the head, and still deeper into that of the neck, and in succession into the trachelo-mastoid, rectus *major* posticus, and *inferior* oblique muscles of the head, and into the periosteum of the upper cervical vertebræ. Some other branches of this artery enter the trapezius muscle, and others anastomose on the top of the scapula with the *transverse thyroid* cervical, and with the *inferior circumflex* scapular arteries.

§ 10. The other branch, the continuation of the trunk of the *profunda* subclavian cervical, or the dorsal artery of the scapula, runs deep under the insertion of the levator muscle of the angle of the scapula, and of the rhomboideus muscle, and extends downwards along the base, and sometimes under the base of the scapula. In the space which this artery runs in the back, it supplies branches to the trapezius, to the serratus *posticus superior*, and to the serratus *magnus*, interscapularis, and to the rhomboideus *major* and *minor* muscles, as also to the longus of the back and sacro-lumbaris muscles. The dorsal artery of the scapula anastomoses with the *superior* scapular artery, and with the *transverse* arising from the *inferior* thyroid artery, at the place corresponding to the top of the scapula; and at the lower part of the scapula, the dorsal artery communicates with the *inferior circumflex* scapular artery, and with the dorsal branches of some of the intercostal arteries. Sometimes the dorsal artery of the scapula does not come off from the *profunda subclavian* cervical, but from the *transverse thyroid* cervical artery.

§ 11. The trunk of the subclavian artery, a little after the origin of the *profunda* cervical, gives off a small artery, to which might, with propriety, be given the name of subscapular artery. This artery, after having given branches to the plexus of the brachial nerves, with which it intermixes, and sometimes another small branch which runs upon the fossa *supraspinata*, where it anastomoses with the *superior* scapular artery, enters and is dispersed within the subscapularis muscle.

§ 12. The subclavian artery having descended under the clavicle into the cavity of the axilla, receives the name of axillary artery. There go off, in the first place, from the axillary artery, the thoracic arteries, sometimes three, four, or six in number. The *first*, or *superior* thoracic, gives branches to the first intercostal muscles, to the pectoralis *minor*, to the skin of the chest, and anastomoses in several places with the *internal* mammary, and *superior* intercostal arteries. The trunk of the *first* thoracic is incurvated, and descends between the pectoralis *minor* and serratus *magnus* muscles, as far as the fourth or fifth rib; it gives branches to these muscles, and renews the anastomoses which it has in the spaces between each rib, with the *internal* mammary, with the intercostal, and with the *second* and *third* thoracic arteries.

§ 13. The *second* thoracic, or the acromial artery arises from the axillary in the vicinity of the second rib. It supplies branches to the pectoralis *minor*, and serratus *magnus* muscles. A branch of it runs along the *sternal* portion of the clavicle, is dispersed on that bone, and then goes to the subclavian muscle, and to the origin of the sterno-mastoid. Above the place of the articulation of the clavicle with the sternum, this artery anastomoses with the *superior thyroid* scapular, with the *internal* mammary of both sides, and with the superior intercostal arteries. The trunk of the *second* thoracic has numerous ramifications within, and under the pectoral muscle, and in the fleshy bundles of the deltoid muscle. It then sends off the acromial artery, properly so called, in the space between the pectoral and deltoid muscles; this acromial artery takes a retrograde course, covered by the deltoid muscle, and proceeds along the anterior margin of the *humeral* portion of the clavicle, and from thence upon the acromion, as far as the spine of the scapula, in which space it anastomoses in several places with the *superior* scapular and *transverse* cervical arteries arising from the *inferior* thyroid; and lastly, with the *profunda subclavian* cervical and circumflex arteries of the humerus.

§ 14. The *third*, or *long* thoracic, or external mammary artery, gives branches to the pectoralis *minor*, to the serratus *magnus* and intercostal muscles, to the superior axillary gland, and to the gland of the mamma; it afterwards anastomoses in several places with the *first* thoracic, with the *internal* mammary, and with the *inferior* intercostal arteries, as far as the fifth rib.

§ 15. The *fourth*, or *axillary glandular* thoracic artery, (thoracica humeraria) which is sometimes only a branch of the *inferior* scapular artery, gives several branches to the *great* rotundus, (teres major), to the great dorsalis, the serratus *magnus*, the subscapularis, and to the long portion of the triceps extensor muscle, where it anastomoses with the *profunda* humeri, and then sends off several other branches to the lymphatic glands, situated in the cavity of the axilla. The thoracic axillary artery then extends downwards, as far as the sixth or seventh rib, where it anastomoses with the *long* thoracic, with the intercostal and *internal* mammary arteries.

§ 16. The axillary artery continues to descend in the cavity of the axilla, resting upon the head of the subscapularis muscle, to which it gives several small branches, as well as to the cords which form the root of the median nerve, which surround the artery, and also some small branches to the superior axillary lymphatic glands. On reaching the anterior margin of the scapula, the axillary artery gives other twigs, which spread upon the beginning of the coraco-brachialis muscle, and on the articular ligamentous capsule of the humerus; and then the great *inferior* scapular artery comes off from the trunk of the axillary artery.

§ 17. The *inferior* scapular artery gives off, in the first place, one or more branches, which partly sink into the subclavian muscle, and are partly dispersed upon the periosteum of the hollow of the scapula, where they form arches of communication with each other, and with the *superior thyroid* scapular artery. (See Haller Fasc. vi, tab. ii, fig. 11). Other branches, proceeding from the same origin, go to the *small* and *great* rotundus, (teres major and minor), and to the great dorsalis, (latissimus dorsi), muscle. The *inferior* scapular artery then turns from the inner to the outer side of the scapula, and assumes the name of circumflex artery of the scapula. The circumflex artery, covered by the infra spinatus muscle, ramifies freely on the dorsum of the scapula. One great branch of this artery goes upwards between the cervix and the root of the coracoid process of the scapula, and there forms the great anastomosis between the *superior thyroid* scapular, and the *inferior axillary* scapular artery. From these anastomoses are given off branches, which spread upon the ligamentous capsule of the head of the humerus; and upon the *long* portion of the triceps extensor muscle of the arm. The *great* rotundus, (teres major), and the great dorsalis muscles, also receive branches from the circumflex artery of the scapula. Farther, this circumflex artery anastomoses in many places, and especially along the spine, and base of the scapula, with the *transverse thyroid* cervical artery, with the *profunda subclavian* cervical, and with the dorsal artery of the scapula, and with the inferior intercostals, whether the dorsal artery of the scapula comes off from the *thyroid* cervical, or from the *profunda subclavian* cervical artery.

§ 18. A little below the origin of the *inferior* scapular, the two circumflex *humeral* arteries arise from the axillary artery, viz. the *anterior* and *posterior*; they sometimes come off by a distinct, sometimes by a common origin from the axillary artery. Sometimes the *anterior* circumflex *humeral* arises from the *inferior* scapular artery.

§ 19. The *anterior* circumflex of the humerus, invariably smaller than the *posterior*, is covered by the superior portion of the coraco-brachialis muscle, and by the short head of the biceps, to which it furnishes branches, as also to the great rotundus, (teres major), and dorsalis, (latissimus dorsi) muscles, in the vicinity of their insertion into the humerus, and sometimes likewise to the subclavius, and to the beginning of the brachialis internus muscles. The *anterior* circumflex artery having reached the anterior internal surface of the head of the os humeri, is reflected upwards, and disperses numerous branches to the articular capsule of the head of that bone. The trunk of this artery goes backwards along the furrow in the tuberosity of the head of the humerus, within which the long tendon of the biceps muscle runs, and ramifies upon the tendons of the supra spinatus and infra spinatus muscles, and then anastomoses repeatedly with the *superior thyroid* scapular, and with the *posterior* circumflex artery of the humerus. Another branch of the *anterior* circumflex artery, descends along the humerus, resting upon the insertion of the *great* dorsalis muscle, and gives branches backwards towards the acromion, which communicate with those of the *superior thyroid* scapular artery, with those of the *acromial* thoracic, and of the *posterior* circumflex of the humerus. There are some other more considerable branches than the preceding, sent off from the lower part of the *anterior* circumflex artery, which form a conspicuous anastomosis between the *anterior* circumcumflex artery, the *profunda* humeri, and the *posterior* circumflex artery of the humerus. The continuation of the trunk of the *anterior* circumflex artery of the humerus penetrates the bundles of the deltoid muscle, within which it communicates with branches of the *posterior* circumflex, the description of which follows immediately.

§ 20. The *posterior* circumflex artery *of the humerus* surrounds the neck of that bone, from the inner to the outside, passing between the insertion of the great and little rotundus, (teres major and minor), and the *long* head of the triceps extensor, to which muscles it gives branches, as well as to the coraco-brachialis, and to the *short* head of the triceps extensor muscle, and at the same time to the periosteum of the os humeri. This artery also gives several branches to the articular capsule of the head of the humerus, which anastomose with those which come from the union of the *superior thyroid* scapular, with the *inferior* scapular artery. The principal trunk of the *posterior* circumflex artery gives numerous branches to the muscular fibres of the deltoid muscle, and anastomoses on the edge of the acromion, with the vascular net-work formed by the junction of the *superior thyroid* scapular, with the *transverse subclavian* cervical artery; it then communicates with the *anterior* circumflex, and with the *profunda* humeri. The axillary artery, under the place where it gives off the *posterior* circumflex artery, assumes the name of humeral artery.

§ 21. The humeral artery, from the edge of the great rotundus, (teres major), and great dorsalis, (latissimus dorsi), ascends gradually from within the cavity of the axilla forwards, and proceeds along the inner side of the biceps and brachialis muscles. Several branches are given off from the inner side of the humeral artery, which sink into the coraco-brachialis, biceps and brachialis muscles, and likewise into the periosteum of the bone. Some of these branches follow the median nerve. Then, at a little distance from the edge of the tendon of the great dorsalis muscle, the profunda humeral artery arises from the common humeral artery. This artery sometimes goes off from the *inferior* scapular, or from the *posterior* circumflex artery *of the humerus.*

§ 22. The profunda humeral artery, sometimes double, runs for a certain space along the internal surface of the humerus, between the *long* and *short* heads of the triceps extensor muscle; it is then hid, and reflected from the internal and lower to the external and upper side of the humerus. The first branches, which go off from the profunda humeral artery, sink into the *long* and *short* heads of the triceps extensor muscle, where some of them anastomose with the *posterior* circumflex artery of the *humerus.* The coraco-brachialis, the brachialis internus, and the inferior portion of the deltoid muscle, receive some branches from it. There is constantly given off from the profunda humeral a considerable artery, which, after having given branches to the biceps, to the lower portion of the deltoid, and to the brachialis internus muscles, runs behind the coraco-brachialis, and is dispersed upon the periosteum of the os humeri, in the vicinity of the insertion of the great dorsalis muscle; there, having divided into several branches, it sends some retrograde ones, which anastomose with the two circumflex arteries, and others bending from above, downwards, which are distributed upon the periosteum of the humerus. The continuation of this artery penetrates into the os humeri, and constitutes the *superior nutritious* artery of that bone. The trunk of the profunda humeral artery, accompanied by the radial nerve, surrounds the os humeri, and re-appears on the external and superior edge of that bone; from thence it descends along the linea aspera, towards the superior or *external* condyle of the humerus, and then divides into *radial* and ulnar branches. The radial branches of the profunda humeral artery proceed superficially along the linea aspera of the os humeri, between the *short* belly of the triceps extensor muscle and the humerus, furnishing branches to that muscle, to the brachialis internus, and to the supinator *longus* muscles. The principal of these branches sink deep between the *external* or superior condyle of the humerus, and the radialis *longus* and *brevis* muscles, and anastomose with the recurrent radial artery. Another of the *radial* branches of the profunda humeral artery, or rather the continuation of the trunk of that artery, extends on the outer surface of the superior condyle of the os humeri, and there anastomoses repeatedly with the *interosseous* recurrent artery, and with the collateralis *profunda* of the elbow. The *ulnar* branches of the profunda humeral artery are distributed partly to the two united heads of the triceps extensor muscle, partly extend under that muscle, among its fibres, and finally anastomose in the bend of the elbow, in the neighbourhood of the *internal* or inferior condyle of the humerus, with the collateralis *profunda* of the elbow. In some subjects, these arterial *ulnar* branches come off from the profunda humeral artery much higher up; on which point see Haller, *Fasc. Anat. viii. tab. art. tot. corp. post. dexter. u. x. y.*

§ 23. The humeral artery, continuing its course along the internal edge of the biceps muscle, and gradually advancing more forwards, gives branches to the biceps and brachialis internus muscles, and to the periosteum of the humerus. It supplies likewise the triceps extensor muscle. It then gives off the *superior* collateral, and, a little lower, in the vicinity of the bend of the arm, the *inferior* collateral artery. In the interval between the origin of the two collaterals, several small arteries come off from the trunk of the humeral, which sink into the brachialis internus and triceps extensor muscles, and into the periosteum of the lower portion of the humerus, forming many arches of communication with each other, and with the neighbouring arteries; one of these enters into the humerus, and constitutes the *inferior nutritious* artery. The *superior* collateral artery descends along the inner side of the humerus, in the course of the ulnar nerve. It gives branches to the triceps brachialis muscle, and, in the vicinity of the internal condyle of the humerus, anastomoses with the *inferior* collateral, and with the *anterior ulnar* recurrent arteries. Having made this considerable double anastomosis, the *superior* collateral artery bends behind the internal condyle, and enters the posterior fossa of the humerus, under the insertion of the tendon of the triceps brachialis muscle. The *superior* collateral artery then forms an arch, situated deep between the ollecranon and the inferior extremity of the humerus, which anastomoses with the profunda humeral artery, with the recurrent *interosseous*, and with the *deep* branch of the *ulnar* recurrent artery, and it gives branches which insinuate themselves into the cavity of the articulation of the elbow. Some branches of the *superior* collateral artery, at first distributed upon the muscles, reunite afterwards with this arterial arch, under the insertion of the triceps brachialis muscle.

§ 24. The humeral artery, in the bend of the arm, or a little above it, resting on the brachialis muscle, divides into the radial and ulnar arteries.

§ 25. The radial, just at its origin from the humeral, or a little below, gives off the recurrent *radial* artery. The recurrent *radial* artery is reflected in the bend of the elbow, between the tendon of the biceps and supinator *longus* muscles, in the neighbourhood of the radial nerve. This artery gives branches to the supinator *longus* and *brevis*, to the two radiales muscles, to the brachialis internus, to the periosteum of the head of the radius, and of the lower extremity of the humerus, and to the ligaments which surround the junction of these bones. Then the recurrent *radial* artery, covered by the heads of the radiales and supinator *longus* muscles, having divided into several branches, runs above the articular radial condyle of the humerus, going from the inner towards the outer side of the elbow, in which place it anastomoses repeatedly with the profunda humeral, and with the recurrent *interosseous* artery.

§ 26. The ulnar artery, in like manner, not long after its origin from the humeral, gives off the recurrent *ulnar* artery. This last artery is distinguished into *superficial* and *profunda*. The *superficial ulnar* recurrent artery passes back between the pronator *rotundus* (pronator teres), the brachialis internus muscles, and the *inner* condyle of the humerus. It gives branches to these muscles, to the periosteum, and to the skin which covers the *internal* condyle of the humerus; it then anastomoses a little above the internal condyle, with the two collateral branches of the humeral artery. The recurrent *profunda ulnar* artery is then hid between the internal condyle of the humerus and the ollecranon, and having passed the heads of the flexor muscles of the fingers, and the extensor ulnaris of the carpus, to which muscles it gives branches, it communicates with the recurrent *interosseous* artery, and then appears on the external surface of the elbow; from thence it ascends between the internal condyle of the humerus and the ollecranon, and in the posterior fossa of the lower extremity of the humerus, anastomoses with the arterial arch of the *profunda* collateral artery of the elbow. It ramifies upon the ollecranon, and communicates with the vascular plexus, formed by the union of the interosseous recurrent and profunda humeral arteries, and gives branches to the articular capsule, and to the internal parts of the articulation of the elbow.

§ 27. The recurrent *interosseous* artery ascends along the supinator *brevis* and anconeus muscles, as far as the articular head of the radius, and gives branches to the joint of the elbow; then, on the posterior surface of the internal condyle of the humerus, it anastomoses with the recurrent *radial*, with the *profunda* humeral, and with the arterial arch of the *profunda* collateral artery of the elbow. A branch of the recurrent *interosseous* artery, covered by the anconeus muscle, advances upon the ollecranon, where it anastomoses with the *profunda ulnar recurrent* artery.

§ 28. The arteries which ramify upon the periosteum of the humerus arise from various sources. The superior arteries of the periosteum come from the scapular, and from the circumflex arteries of the humerus; lower down, from the profunda humeri, and from the humeral artery; still lower, from the recurrent *radial* arteries, from the *superficial ulnar* recurrent and collateral arteries. Farther, the periosteum receives some small arteries from the humeral branches, and from the profunda humeral artery, which ramify within the brachialis internus and triceps extensor muscles. All these arteries of the periosteum communicate with each other, both on the anterior and posterior surface of the humerus, and all of them finally anastomose with the recurrent *radial*, *ulnar*, and *interosseous* arteries.

CHAPTER IV.

COROLLARIES.

§ 1. As, in the inferior extremity, the arterial anastomoses are arranged by nature into two orders; into the one between the arteries of the abdomen, thorax and pelvis, with the common femoral artery, both above and immediately below the crural arch; and the other, including those anastomoses which occur between the *superficial* femoral and the *profunda*, along the thigh and round the knee; so in the same manner, in the superior extremity, two orders of arterial anastomoses are also met with; the one between the arteries of the neck, thorax, and scapula, with the subclavian and axillary arteries; the other between the brachial and the *profunda* humeral arteries, along the humerus, and round the elbow.

§ 2. In the supposition, therefore, that the course of the blood is interrupted through the axillary artery, from some morbid indisposition, or intentionally, and by the assistance of art, from the site of the clavicle, as far as the origin of the *inferior* scapular artery, the arm is not thereby deprived of circulation and life. For the blood propelled through the *inferior* thyroid artery, and through that tract of the subclavian intervening between its origin, from the arch of the aorta, beyond the scaleni muscles and first rib, takes the route of the *superior thyroid* scapular arteries, of the *transverse thyroid* cervical, of the *transverse subclavian* cervical, and dorsal artery of the scapula, and passes into the *inferior* scapular artery, and from thence into the axillary artery, under the place of the obstruction, after having completed the circle of the scapula. In the greatest degree of derivation, the blood may be drawn from the vertebral and occipital arteries, to the place just mentioned, by means of the communications which these two arteries have with the *deep* and *superficial* branches of the *ascending* thyroid artery, with the superior branches of the *transverse thyroid* cervical and *subclavian* cervical arteries. In every case, therefore, where the obstruction is only a little below the clavicle, the axillary artery may be supplied with blood from the *internal* mammary, and from the superior intercostal arteries, by the numerous anastomoses which these arteries have with the thoracic arteries. The blood may also be derived from the *transverse* cervical and *superior* scapular arteries, by means of the communication which these arteries have on the acromion, and in the superior fossa of the scapula, with the *acromial* thoracic artery.

§ 3. Although the derivation of the blood of the aorta into the axillary artery, by the route of the *inferior* scapular, were prevented, nevertheless the blood of the *superior thyroid* scapular, and of the *transverse* cervical arteries, might be conveyed from the aorta into the axillary artery, under the origin of the *inferior* scapular, by the two considerable circumflex arteries of the humerus. For, the *posterior* circumflex artery of the humerus communicates, on the articular capsule of the head of that bone, with the two scapular arteries; and further, with the *superior thyroid* scapular, and with the *transverse* cervical arteries, in several places, along the acromion and spine of the scapula. The *anterior* circumflex artery intermixes, in these anastomoses, with the superior scapular and cervical branches of the thyroid artery, and communicates likewise with the *posterior* circumflex. From which circumstance, the blood of the aorta finds several ways of passing into the axillary artery, by the arteries of the neck, and of those of the top of the scapula, although there be an obstruction of its trunk below the origin of the *inferior* scapular artery.

§ 4. If the obstruction to the passage of the blood is still lower, under the origin of the *inferior* scapular artery, as, for example, opposite to the insertion of the great rotundus (teres major), and great dorsalis muscles, then the blood of the aorta, from the arteries of the neck, as has been just mentioned, passes into the circumflex arteries of the humerus, and from these into the trunk of the humeral artery, by means of the considerable anastomoses which these two circumflex arteries have with the profunda humeral artery.

§ 5. In whatsoever manner the great humeral artery may be compressed, obstructed, or tied, for a considerable space below the place corresponding to the insertion of the great rotundus (teres major), and great dorsalis muscles, that is to say, below the origin of the profunda humeral artery, the course of the blood is not therefore intercepted to the forearm and hand; because, in these circumstances, the blood of the axillary artery takes the route of the profunda, and in that way enters the radial, ulnar, and interosseous arteries, below the bend of the elbow, through the medium of the recurrent *radial* and *ulnar* arteries,

§ 6. If the obstruction to the course of the blood through the humeral artery is only a little above the bend of the elbow, then the blood of the axillary artery, besides the channel of the profunda humeral, takes also that of the collateral arteries: from these arteries it enters partly into the *superficial ulnar* recurrent, partly runs along the *superior* collateral artery, behind the internal condyle of the humerus, into the *deep anastomotic* of the elbow, and then by the *posterior ulnar* recurrent, the recurrent *interosseous*, and the recurrent *radial* arteries, along with the blood conveyed by the profunda humeri, into the principal arteries of the fore-arm, below the bend of the elbow.

§ 7. And farther, there is another mode of communication, as has been mentioned in speaking of the inferior extremity, viz. that which takes place between the arteries of the neck, scapula, and humerus, with those of the fore-arm, below the bend of the elbow, by means of their numerous communicating arteries on the periosteum of the humerus: for the arteries of the periosteum are derived from many sources, especially from the two circumflex arteries of the humerus, from the profunda humeral, from the *superior* and *inferior* collaterals, and from the humeral artery for a long space. All these arteries of the periosteum of the humerus, by means of repeated arches, communicate with each other along the whole os humeri, both on its anterior as well as its posterior surface. This vascular net-work is then found to anastomose at the upper part with the arteries descending from the neck to the acromion, round the articulation of the humerus with the scapula, and upon the capsular ligament of the head of the humerus; and at the lower part it anastomoses with the *radial*, *ulnar*, and *interosseus* recurrent arteries, by which channels the blood finds a passage from the top of the arm into the arteries of the fore-arm, upon the periosteum of the humerus, by means of these arteries, and within the substance of the bone, through the superior and inferior nutritious arteries, although the principal trunk of the humeral artery be obstructed at a greater or less distance above the bend of the arm.

§ 8. And if, as has been mentioned with regard to the thigh and leg, we add to all these anastomoses existing among the arteries of the superior extremity, the almost innumerable communications which occur between the arteries of the common integuments, and of the cellular substance, both subcutaneous, and intermuscular, through the long tract from the neck to the fingers; which arteries are derived from many distinct origins, and constitute together a vast vascular plexus, extended over the whole length of the superior extremity, the sum of the described anastomoses is so prodigiously increased, that no one, who is well acquainted with this structure, would hesitate for a single moment to believe, that the humeral artery may be safely tied at any point, even in the cavity of the axilla, without any fear of destroying the circulation and life of the lower part of the limb.

§ 9. The ancient surgeons were only acquainted with a few of these arterial communications in each of the extremities; but ever since the art of injection was introduced into anatomy, and cultivated, this communication has been discovered to be very much extended, not only between the arteries of the distinct parts of each limb, but also between those of different divisions of the arterial system. To this system may be justly applied the saying of Hippocrates, *in toto corpore unus consensus et una conspiratio*; for it may be boldly stated, that the whole body is an anastomosis of vessels, a vascular circle. This fact is so true, that although in some rare cases there may occur a constriction and obliteration of the trunk of the great artery of the body, (I mean the aorta), immediately below the arch which this artery makes, the circulation through the rest of the body, from the neck to the feet, is not thereby stopped or obstructed. For M. Paris,[a] who happened to observe this rare occurrence in the body of a woman, viz. the constriction and obliteration of the tube of the aorta, a little beyond its arch, found in that case, that during the life of the woman, the blood sent by the heart was conveyed into the trunk of the aorta below the place of the constriction, through the subclavian, axillary and cervical arteries, into the mammary, intercostal, diaphragmatic, and epigastric arteries; and that from thence it was conveyed to the viscera of the thorax and abdomen, and to the lower extremities. Stenzel[b] found in the body of a man two *steatomatous* tumours formed in the substance of the membranes of the aorta, immediately below its arch, which almost entirely closed its tube, though this subject had always the habit of body of a well nourished and robust man. Mekel[c] in the bodies of two subjects, found the aorta just below its arch, so much thickened and constricted, that the blood impelled by the heart could pass with great difficulty, and in small quantity, and regurgitated so strongly towards the heart, that it had lacerated the *semilunar* valves; notwithstanding which, there was no appearance, in these subjects, of the viscera of the abdomen, or the inferior extremities, having been deprived of the usual quantity of blood circulating in them. I have repeatedly had occasion to observe, what others may likewise see at pleasure, that on tying tightly the aorta in the dead subject, immediately below its arch, in order to throw with great force the injection into the arterial vessels of the head and arms, a very fluid injection has likewise found its way, by the vessels of the neck, by the subclavian, by the dorsal, and especially the two upper intercostal arteries, into the arteries of the thorax, and to those of the abdomen, and for a long space, even to the principal arterial trunks of the lower extremities. All surgeons now know, that in brute animals, one, or even both carotid arteries may be tied, without the circulation of the blood through the external or internal parts of the head being impeded or greatly disturbed. In the thorax, the mammary, mediastinal, and intercostal arteries, keep up a numerous and free communication between each other, and at the same time between the trunk of the thoracic aorta, and the continuation of the ventral aorta. In the abdomen, the remarkable arches formed by the cæliac and mesenteric arteries, although each of these arteries seems to define the limits of each viscus to which it is destined, form nevertheless all together a numerous series of anastomoses among these ventral arteries. In the fetus, the two great arteries of the body, the pulmonary artery, and the aorta, anastomose together in such a manner, that the pulmonary artery in the fetus may be said to be continued into the aorta. The same may be said of the arteries both of the superior and inferior extremities. For if in the former, as well as in the latter, the arteries communicate with each other from their origin to their termination, following the constant rule, that every great anastomosis of a limb comprehends within it a connection like the links of a chain; which is as much as to say, in the inferior extremities, the first great anastomosis includes the connection of the pelvis and thigh; the second, that of the femur with the tibia; the third, that of the tibia with the foot, in such a manner, that, all these circles communicating together, the passage of the blood from the first to the last of these anastomoses is perfectly free. In the same manner we observe, in the superior extremity, that the first great circle or anastomosis includes the union of the scapula with the humerus; the second, that of the humerus with the fore-arm; and the third, that of the fore-arm with the hand, and the blood, passing from the one to the other of these anastomoses, traverses the whole length of the superior or inferior extremity, whether one of the principal arteries of the limb be pervious, or be from some accident obliterated, or artificially tied.[d]

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[a] Journal de Desault, t. 11, p. 107.

[b] Dissert. de steatomatibus aortæ. Hæc corpora fére cor magnitudine æquabant ut omnem propemodum exeunti e sinistri cordis thalamo sanguini spatium præcluderent.

[c] Mem. de L'acad. R. de Berlin, 1756. Observ. xvii, xviii. Stoerk relates a similar observation. Ann. Med. 11, p. 171.

§ 10. Further, it has always appeared to me worthy of attention, in the distribution of the arteries to all the parts of the body, and more particularly with regard to the arterial anastomoses of the extremities, ing, is not essential to constitute the disease; both because this dilatation of the whole tube of the artery is not a constant occurrence in aneurism; or rather in most cases the aneurism at the curvature of the aorta occurs without this artery being at all, or sensibly dilated beyond its natural diameter; and also, because in those rare cases, in which the aneurism is preceded and accompanied by a certain degree of dilatation of the whole diameter of the curvature of the aorta, there is a very marked and evident difference between an artery simply enlarged in diameter, and the capsule which forms the proper aneurismal sac.

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[d] Arteriæ cum arteriis ita amice conspirant, ut non tantum sua in se mutuo oscula inserant, sed et altera in alterius territorium digressa late diffundetur, ita quidem, ut confiniorum quibus sese attingunt limites ab anatomicis ad unguem definiri neutiquam possint, exceptis iis locis in quibus natura septo cava divisit, et limites diversi agri fixo descripsit termino. Hebenstreit Dissert. de arteriarum confiniis.

§ 2. Several circumstances have given rise to this erroneous opinion, with regard to the nature and immediate cause of aneurism of the aorta. In the first place, and I am sorry to be under the necessity of mentioning it, the little pains which medical men have hitherto bestowed in the dissection of the bodies of those who have died of aneurism: after opening the thorax, they have contented themselves with dividing the sac of the aneurism, and viewing, with useless curiosity, the various and numerous layers of grumous and polypous blood with which the tumour is filled, without examining into the relations between the membranous texture of the aneurismal sac and the proper coats of the injured artery: in the second place, the false analogy between varix and aneurism, commonly received by medical men as true: in the third place, the occurrence of aneurisms of the aorta so large as to raise and even perforate the bones of the thorax, without a single drop of blood being effused into the cavity of the chest: and finally, the having observed that the aneurismatic aorta, as well as the proper sac of the aneurism, were both covered by a *common smooth* membrane, and therefore that both of these parts were included in a *common external covering*, like that which covers the artery in the sound state. All these circumstances have contributed to support this error.

§ 3. But if any person, who is not prejudiced in favour of the common doctrine with regard to the nature and proximate cause of this disease, will examine, not hastily and superficially, but with care and by dissection, the intimate structure and texture of the aneurism of the aorta, unfolding with particular attention the proper and common coats of this artery, and in succession those which constitute the aneurismal sac, in order to ascertain distinctly the texture and limits of both, he will see clearly, that the aorta, properly speaking, contributes nothing to the formation of the aneurismal sac, and that, consequently, the sac is merely the cellular membrane, which in the sound state covered the artery, or that soft cellular sheath which the artery received in common with the neighbouring parts; which cellular substance, being raised and compressed by the blood effused from the corroded or lacerated artery, assumes the form of a circumscribed tumour, covered externally, in common with the artery, by a smooth membrane, such as the pleura in the thorax, and the peritonæum in the abdomen.

§ 4. I do not pretend to deny, that sometimes, in consequence of congenital relaxation of the proper coats of the aorta, at its exit from the heart, a certain degree of yielding of these coats may contribute to the rupture of the aorta at this place, and by that means to the formation of an aneurism, which in this case is likewise conjoined with a certain degree of preternatural dilatation of the whole tube of the artery.[a] I only deny that dilatation of this artery precedes and accompanies every aneurism of the aorta, and am unwilling to admit, that, in the formation of this formidable disease, the proper coats of the aorta ever yield so much to distention as to form the aneurismal sac. With regard to this point, it is a fact worthy of the attention of medical men, and of all those who wish to investigate this subject, that the root of an aneurism of the aorta, in whatever point of this artery it appears, never includes the whole circumference of the tube of the artery; but that the root constantly occupies and involves only the one or the other side of the artery, from which side the aneurismal sac rises and enlarges in the form of an appendix or tuberosity, more or less large and extended, according to the circumstances of the place, or of the period of the disease; while, on the contrary, the dilatation of the artery occurs constantly in the whole circumference of the tube, and therefore differs essentially from aneurism. The smallest arteries of the uterus, for example, assume, in pregnancy, a size three or four times greater than that which they had before impregnation. The arteries of a large incysted tumour, those of the obstructed spleen, and the lateral arteries of a large trunk, through which the course of the blood has been interrupted, dilate beyond what any one would imagine; but the enlargement of these arteries always takes place through the whole circumference of their tube; and a tuberosity is never observed to arise from any side of these dilated arteries, and a receptacle is never formed by their coats, similar to the sac of an aneurism. This invariable fact, with regard to the form of the aneurism of the aorta, cannot fail to point out to the attentive observer, that there ought to be, as there really is, a remarkable difference between a dilated artery and an aneurismatic artery, although these two affections are sometimes found combined together, especially at the beginning of the aorta, as it comes out of the heart. Further, if we consider, in general, that the dilatation of an artery may exist without any affection, properly speaking, organic, the blood being always contained within its cavity; that in the tract of artery, somewhat increased in diameter, there are never formed nor collected any grumous blood or polypous layers; that the dilatation of the diameter of an artery never becomes of such a size as to form a tumour of considerable bulk; and lastly, that as long as the continuity of the proper coats of the artery remains uninterrupted, the circulation of the blood is not at all, or not so sensibly changed, then we shall be obliged to allow, that aneurism differs essentially from the dilatation of an artery. I have many strong reasons for supposing that the polypi, so called, found in the beginning of the aorta, (with regard to the existence of which, physicians of the former century made so much noise), are only aneurisms from previous rupture of the proper coats of the arch of the aorta, in the sacs of which, and not in the enlarged capacity of the arch of the aorta, the stagnating blood, as they supposed, formed that stratified concretion which they improperly compared with the polypi of the nose and of the uterus.

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[a] Wintringham found, that the resistance of the coats of the aorta becomes less, the nearer this artery is to the heart, in the protion of 1794 to 1000. Experim. inquir. on some parts of the animal structure, Experim. 15; which is, as if one were to say, that the larger the artery is, the more easily it is ruptured by the force of the distention, although the increase in diameter be more evident in a large than in a small artery.

Hunter is likewise of opinion, that the muscular coat of the arteries increases in density in proportion as the artery proceeds from the trunks to the branches. He observes, that the increase of the elastic power in the large arterial trunks is well calculated to re-act against the great force of the heart; and that, *vice versa*, the increase of the muscular power, with the diminution of the elasticity in the smaller arteries, is well fitted for accelerating the course of the blood in the extreme minute arterial vessels. And it is also from this that Mr. Hunter proved the equability of the circulation through the whole course of the arterial system.—Posthumous Works, Treatise on the blood.

§ 5. Morgagni[b] has observed and described the difference which exists between these two affections, in the commencement and in the curvature of the aorta. But notwithstanding, it is rather surprising that he should have placed them in the same order of diseases; and he has even taken occasion from that to establish two kinds of aneurism of the arch of the aorta; one, in which the tumour occupies the whole circumference of the arterial tube, the other, in which the aneurism only affects one side of the artery. This last kind he however mentions distinctly to be the one which is most frequently met with in the dissection of dead bodies.[c] Morgagni, though this fact was known to him, did not think it proper to make any change, which he might with propriety have done, in the common doctrine of aneurism. The observations, however, which I shall relate in this chapter, will, I flatter myself, clearly shew, that there is only one form of aneurism, viz. that which occurs in some point of the parietes of the artery, from the rupture of its proper coats; whether the aneurism be complicated with a certain degree of enlargement of the tube of the artery, as sometimes happens in the arch of the aorta, in the vicinity of its exit from the heart, or be without this enlargement of the diameter of the artery, as happens generally, and indeed almost constantly, in cases of aneurism of the thoracic and abdominal aorta.

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[b] Neque enim dubito, quin memineris, fuisse olim aneurysmata a me divisa, in ea quæ vas æque in omnem partem expansum format, et in ea quæ sacci instar a vasis latere excrescunt. Epist. xvii. art. 27. De sed. et caus. morb. This division was also adopted by Schedeiberus, Act. Erud. Lips. an. 1731, and by Valcarenghi us de Aortæ aneurysm, Ob. i; by Sauvage, Nosol. method., who gave the name of cylindrical aneurism to the simple increase in diameter of the great artery.

[c] Loc. cit. epist. xviii. art. 37. Cum aneurysmata quatuor habeam a Cl. Vulpio infarcta, et siccata, eaque omnia sint in arteriæ magnæ aut arcu, aut eo tractu, qui inter arcum et cor interest: eorum unum est primi generis, tria secundi.

§ 6. In consulting the ancients, we do not find in the writings of the Greek and Arabian physicians any mention of *internal* aneurisms. Nor ought that to excite wonder in those who know that these nations were forbid to open human bodies, and that, besides, in brute animals, this organic disease of the great internal arteries is very rare. It was not till about the year 1557, that any certain knowledge was obtained with regard to the existence of *internal* aneurisms. At that period, Vesalius pointed out[d] this disease in the person of Leonard Velserus, in whom, after a fall from a horse, a pulsating tumour had appeared in the back, near to the spine. It is proper to mention, that from that period, in the books of medicine, no other case of this kind has been recorded; for in the year 1595, Silvaticus,[e] who published a particular treatise on aneurism, did not speak at all of *internal* aneurisms, nor did he make any mention of that of the curvature of the aorta, though it is by no means a very rare disease. Riolanus, in the year 1658, many years after Silvaticus, said only,[f] that aneurisms of the aorta arise sometimes, though very rarely, from great thickness and strength of the coats of the artery; and Elsnerus,[g] in the year 1670, when he published the observations of Riva, with regard to aneurism of the arch of the aorta, prefixed to these observations the title *De paradoxico Aneurysmate Aortæ*, as if they related to a thing almost incredible.

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[d] Bonnet, Sepulcr. Anat. lib. iv, sect 2. From the account of what was found in the body, it clearly appears that the aneurism had been formed by a rupture of the ventral aorta. See on this what has been written by Saporta, De Tumor. præternat. lib. i, cap. 43.

[e] De aneurysmat. tractatio, an. 1595.

§ 7. The Greek and Arabian physicians, for these reasons, only made mention in their works of *external* aneurisms, or of those which fall under the inspection and the operation of the hand of the surgeon. And as they wrote only of that which they had repeatedly and attentively observed, without prejudice, they of course spoke only of aneurisms by *effusion*. Galen,[h] Ætius,[i] Paulus,[k] Actuarius,[l] Haly,[m] Albucasis,[n] Oribasius,[o] Avicenna,[p] all hold the same language; and although some of these writers introduce the distinction, that external aneurisms are produced in three ways, viz. by *anastomosis*, by *diapædesis*, and by *diæresis*, they all agree in affirming, that external aneurisms are not formed in any other way than by the extravasation of blood under the skin. Some of the modern physicians conceived that they had found in the works of Ætius some expressions, from which it might be inferred that this writer had distinguished aneurisms into *true* and *spurious*. On examining the text with attention, we find no certain evidence of this; but undoubtedly, that he had distinguished external aneurism by effusion into *circumscribed* and *diffuse*, which distinction is accurate, and conformable to the phenomena which this disease presents. With regard to this subject, it is proper here to remark, that by the word *dilatation*, the Greek and Arabian physicians, in speaking of *external* aneurism, never pretended to signify, as we do, the expansion of the proper coats of the diseased artery, but only to express that tumour which the effused and coagulated arterial blood forms in the cellular membrane under the skin. Ætius precisely states, *oritur dilatatio, aut dum sanguis, et spiritus ex arteriis prosultant; aut dum oscula ipsorum aperiuntur, aut dum rumpuntur. Sanguis autem et spiritus paullatim excreti sub cute colliguntur.* In the same manner Actuarius: *porro arteriam secare plurimum negotii exhibet, siquidem sanguinis fluxus, qui ægerrime sisti possit, et arteriæ dilatationes, quas aneurysmata Græci nominant, hinc oboriri solent.* What other kind of dilatation can ever occur, whether the aneurism be formed by blood issuing from the extremities of the arteries, or oozing out through the pores of their coats, as the ancients thought, or from a wound of the artery, except that produced by the blood having escaped under the skin into the cellular membrane which surrounds the injured artery? M. A. Severinus,[a] guided by observation, and by experience in surgery, was so much convinced that *external* aneurisms were all occasioned by a rupture, or by a wound of the artery, and that consequently they were only formed by blood effused into the subcutaneous cellular membrane, that he thought proper to refer the history of this disease to the chapter *De abscessibus sanguifluis.* Silvaticus also, a very skilful physician, and well versed in the works of the ancient Greek and Arabian physicians, confirms this fact, relative to the opinion which the ancients entertained concerning the nature and character of *external* aneurism. For he writes: *est aneurysma tumor a sanguine calidissimo, tenui, vaporosoque ex arteria sub cutem effuso productus. Arteriæ divisionem, quomodocumque factam generationis occasionem esse dicendum est. Effluere autem ex arteriis sanguinem, vel per anastomosim, hoc est apertis vasis osculis; vel per diapedesim, id est rarefactis ejus tunicis; vel per diæresim, id est ruptis, vel exæsis illis.*

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[f] Enchierid. Anat. lib. v, cap. 46.

[g] Acad. nat. cur, an, i, decad. i, obs. 18.

[h] Method. Med. cap. vii—de Tumoribus, cap. vii.

[i] Tetr. iv, Serm. iii, cap. x.

[k] De re Med. lib. vi, cap. 37.

[l] De Meth. Med. lib. iii, cap. 2.

[m] Lib. viii, cap. 17.

[n] Chirurgia, lib. ii, cap. 49.

[o] Lib. vii, cap. 13, 14.

[p] Lib. i. par. ii, cap. 4.

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[a] De nov. observ. abscess. cap. 7.

§ 8. Fernelius, as far as I know, was the first who conceived the idea of publishing the theory of the *dilatation* of the coats of the arteries, as the proximate cause of aneurisms, particularly of *internal* aneurisms, or as applicable to those of the curvature and trunk of the aorta, arising from internal, and not evident causes. He conceived,[r] that the internal spontaneous aneurism consisted in a morbid distention of all the coats of the artery, just as is observed to take place in the coats of the veins, in the case of varix. Any one not acquainted with the history of medicine would perhaps suppose that Fernelius was induced to publish this new theory, quite different from that of the Greek and

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[r] Opera omn. de extern. corp. affect. lib. vii, cap. 3.

Arabian physicians, in consequence of repeated researches on the dead subject, and of exact comparisons of the nature of the proper coats of the artery, and of those which constitute the aneurismal sac; but if they would wish to be fully informed of this, they will find, that the theory of Fernelius, far from having been deduced from observation on the dead subject, was only the result of his own imagination, and of an hypothesis which he drew from this false conjecture, viz. that the effused arterial blood would be immediately converted into a putrid mass, whenever the aneurismal sac was not formed by the proper coats of the artery; and that the arterial blood would never form a *pulsating* tumour, when the tumour was not circumscribed and formed by the proper coats of the dilated artery. These two inconclusive ideas were the basis of the theory of Fernelius; notwithstanding, they were soon afterwards refuted by Slivaticus;[a] and although, I believe, at the time of Fernelius, there was not one distinguished surgeon, who had not repeatedly had occasion to observe aneurism in the bend of the arm occasioned by a wound of a lancet, and consequently from effusion of arterial blood into the surrounding cellular substance, which, nevertheless, was circumscribed, pulsated, and contained blood perfectly free from putrefaction, though long effused; yet the theory of Fernelius was received by many as a matter of fact, and what is still more wonderful, has been regarded as such, even to the present day, by the greater number of physicians and surgeons. I omit mentioning here the long list of those who adopted this opinion, and shall content myself with mentioning Forestus only,[c] on account of the singularity of the following circumstance; for, while this author used every force of reasoning to maintain that the internal spontaneous aneurism is formed by the dilatation and distention of the coats of the artery, he adduces, in proof of that opinion, an observation, the only one of the kind to be found in all his works, from which a precisely contrary conclusion may be fairly deduced, viz. that the aneurism which he describes was not formed by a dilatation, but by a rupture of the coats of the artery, and consequently by an effusion of arterial blood into the surrounding cellular substance.

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[a] See note, No. 1, appendix.

[c] Oper. Med.

§ 9. Such was not the opinion of Sennertus;[u] for, guided by solid anatomical knowledge, and by mature reflection upon the phenomena which precede and accompany *external* as well as *internal* aneurisms, he differed in opinion from Fernelius, and appeared inclined to believe, that the proximate cause of internal aneurisms consisted, not in the dilatation, but in the rupture of the internal proper coats of the arteries; the external membrane, or the external cellular coat of the arteries remaining untouched; which external cellular membrane, when elevated and distended by the extravasated arterial blood, forms ultimately the aneurismal sac. He says, that as in the aneurism which arises in consequence of a puncture of the artery at the bend of the arm, the external cellular coat of the artery, being soft and flexible, heals, while the internal coat of the artery, being hard and rigid, does not cicatrise at all, and remains open at the place where it was wounded; so, every time this internal coat of the artery is ruptured by a violent impetus of the heart, the external membrane of the artery, from being soft and easily distended, is elevated by the effused arterial blood, and is gradually converted into an aneurismal sac. Upon this point it appears that Sennertus had derived some light from the works of F. Hildanus.[*] For, this celebrated practitioner had already explained, nearly in the same terms, his opinion with regard to the manner in which the aneurism in the bend of the arm is formed, in consequence of a puncture made with a lancet in the brachial artery. Sennertus went a step farther, in applying the same theory to the explanation of *internal spontaneous* aneurism, independent of a wound, or other external violence done to the principal trunks of the great arteries. Both Hildanus and Sennertus therefore were of opinion, that, whenever the arterial blood was much diffused round the place of the rupture, and the internal as well as the external membrane of the artery ruptured, the tumour thus formed would be neither *circumscribed*, elevated, nor *pulsating*; but that in similar circumstances the extravasated blood would corrupt and occasion inflammation and gangrene in the neighbouring parts. In this supposition, likewise, these two celebrated writers have not deviated far from the truth; as these are indeed the most frequent consequences of the *diffuse* aneurism. Their doctrine with regard to the nature and true character of aneurism was judiciously approved of and published by Barbette,[x] Diemerbroech,[y] Jonstone,[z] Gouey,* and many others whom it would be too tedious to mention.

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[u] Oper. omn. t. v. lib. v. part. i. cap. 43. Atque ita proxima causa Aneurysmatis est arteriæ tunicæ internæ aperitio, exterioris vero dilatatio. Aperitur autem frequentissime sectioni, dum imperiti chirurgi pro vena arteriam, vel cum vena arteriam perforant. Id enim si fit, externa tunica facilius, utpote mollior, et venarum tunicis cognata, coalescit; intimior vero durior aperta manet; unde per foramen sanguis, et spiritus vitalis errumpere conatur, atque ita externam tunicam distendit, et hoc tumoris genus efficit. Idem accidere potest, si a vehementi sanguinis arteriosi impetu, vel causa externa violenta, nimiaque arteriæ distentione, interna tunica arteriæ rumpitur, externa, quæ ad extentionem magis apta est, salva, et incolumi.

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[*] Oper. omn. Centur. III. obs. 44. Duplici tunica arteriam donatam esse Galenus testatur, quarum exterior tenuis, et mollis ex rectis et obliquis fibris contexta; interior altera ſere, eodem Galeno monente, quintuplo durior, et densior est. In aneurysmate itaque interiorem tunicam rumpi, exteriorem vero dilatari verosimile est. In hoc autem viro, etsi ambo tunicæ scalpello perforatæ essent, exterior tamen, quia tenuis, et carni atque venis proxima, mox iterum coaluisse mihi videtur; interior autem, cum propter motum vehementem, et continuum, necnon duritiem simul claudi non potest, sanguis paullatim per eam in exteriorem tunicam influebat, eamque extendebat.

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[x] Oper. med. et Chirurg. part ii. cap. 16. Aneurysma est tumor præternaturalis ab arteriæ cujusdam ruptura exorta, continuo pulsans, digitis libenter cedens, ast etiam facile rediens. Arteriæ omnes, exceptis iis, quæ per cerebrum, partesque omnes alias consistentes magis dispersæ sunt, tunica duplici gaudent. Harum interna corrosa, aut rupta, externa in tantum extendi potest absque ruptura (quidquid etiam contradicant alii); ut aneurysma causetur. Nihilo minus, ubi tumor hic pugni magnitudinem habet, haud fieri potest quin simul etiam externa corrosa, aut rupta sit. Anatome sententiam nostram confirmat; artis chirurgicæ studiosi etiam mecum inquirant.

[y] Oper. omn. lib. vi. cap. 1. Ratio docet, quod arteriæ nisi a transversis fibris firmarentur, per magnas pulsationes nimis dilatarentur, et dilatatæ manerent, utpote destitutæ fibris a quibus rursus contrahi possunt. Hæc enim causa est aneurysmatis, quod, tunica cum suis fibris rupta, sanguis in primam, seu extimam tunicam illabitur, quæ ob mollitiem mox extenditur, sicque ibi tumor generatur.

[z] Sintagma med. pag. 548. Aneurysma tumor est ab arteriæ tunicæ interioris apertione, exterioris dilatatione exortus.

* La veritable Chirurgie, pag. 231. Le vray aneurisme est une tumeure sanguigne faite dans le propre canal de l'artére et dont

§ 10. Dr. Freind, in his History of Medicine, under this head says, that upon the whole subject of aneurism, he had been able to find only a successive series of hypotheses and conjectures, and everywhere involved in obscurity and confusion.[a] It is not conceivable, he remarks, how the rupture of the internal membrane of an artery should not be immediately accompanied by that of the external one also, as the external is less dense and firm than the internal coat. The same difficulty had already been stated by Muraltus,[b] who however admitted the possibility of this fact, in the case where, during the time which the process of ulceration takes up in removing the continuity of the internal coat of the artery, the external membrane of the artery acquired a density and firmness much greater than that which it naturally has, preserving at the same time sufficient flexibility to yield gradually to the impulse of the arterial blood, and to permit it to be raised into a tumour by that which was extravasated. To confess the truth, far

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la cause se trouve, dans l'acrimonie de quelque humeur, qui a rongé la tunique interieure de ce vaisseau, ensorte que les secousses reiterées du sang ont forcé les tuniques exterieures à s'étendre, de maniere que il s'estformé comme une espece de cul de sac, dans lequel le sang arteriel est entré pour former une tumeur qu'on appelle aneurisme.

[a] Hist. Med. Paulus. Neque argumentum de quo scribere aggressi sunt, neque id ipsum, quod super argumento suo scripserint satis comprehendentes.

[b] Ephem. nat. cur. Decad. ii. an. 3. Rupturam interioris tunicæ ex triplici substantia constantis, exterioris autem extensionem admitti vix posse. Cum vix credibile sit internam, et crassam satis rumpi posse, externa tenuissima salva remanente; nisi forte internam duriusculam a sanguinis stagnantis acrimonia erodi, externa interim crassiori reddita, et sanguini irruenti extensioni sua, utpote molliori, amplius spatium cedente, dicere liceat.

from finding, as Dr. Freind writes, hypotheses, contradictions, and confusion in the doctrine of Hildanus, and Sennertus, and of others who, following the instructions of these two illustrious authors, have made mention of the nature and proximate cause of *internal* spontaneous aneurisms, I am rather of opinion that these two celebrated physicians are the only ones, who, with regard to this point, have come near to the truth; and that on the contrary, the modern physicians, entirely from having abandoned the steps marked out by these two distinguished men, have greatly receded from the straight path, which would have conducted them to the perfect knowledge of the true nature of this disease. The repeated investigations which I have made with regard to this important subject, authorize me to assert, that Hildanus and Sennertus had only a short step to make, to give to their theory concerning the proximate cause of aneurism all that degree of demonstration and proof, of which the subject is susceptible. This short step consisted in determining, with anatomical precision, the relations of the proper coats of the artery with its external cellular covering, and in demonstrating, by means of accurate dissections of arteries, both in the sound and morbid state, what share the proper and constituent coats of the artery had in the formation of the aneurismal sac, and what belonged to the cellular covering and the other adventitious membranes surrounding the affected artery; these are the circumstances which I now propose to detail, and to place, as far as lies in my power, in the clearest light.

§ 11. The covering of the artery, which former anatomists, almost to the present day, have mentioned amongst the component coats of an artery, is by no means such as they have described it, but is merely an adventitious sheath,[c] or cellular covering, which the artery borrows, or receives in common with the parts, in the vicinity of which it runs; by means of this cellular sheath the artery is kept in its place, as within a soft bed, and connected to the parts surrounding it, such as the membranes, the viscera, the nerves, the aponeurotic and ligamentous fasciæ, the muscles and periosteum. On cutting an artery across in its natural situation, it is observed to be inclosed in a sheath of soft, spongy, easily distended cellular substance, within which sheath, the segment of the cut artery retires and conceals itself. This cellular sheath, most evident round the great arterial trunks, is in some places more dense and abundant, in others less so. It is found in considerable quantity, and very dense round the curvature and trunk of the aorta, the carotid arteries, the mesenteric and renal arteries; but less so round the trunk of the brachial, femoral, and popliteal arteries. In all these parts, the cellular sheath, soft and easily distended, is only a continuation of the cellular membrane of the neighbouring parts. The pleura lies over the cellular sheath of the arch of the aorta, and over that of the thoracic aorta; and that of the abdominal aorta is covered by the peritoneum. Both of these smooth membranes surround and adhere closely to the aorta for two thirds of its circumference. The great arteries of the extremities, which run between the muscles, and under the aponeurotic and ligamentous fasciæ, are not covered, in addition to the cellular substance, by a smooth membrane, such as the pleura and peritoneum, but they are surrounded by a cellular sheath, which, although it is here and there filled with an oily substance, may notwithstanding be demonstrated to be distinct from the membrane properly called adipose, and which serves, as in the other parts of the body, to inclose the tube of the artery, and connect it to the contiguous parts.

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[c] Monro's works.—Ludwig de arteriarum tunicis. Haller Elem. Phisiol.—cellulosa adscititia.

§ 12. If, leaving the aorta in its place, as well as the viscera near it, a little air, or any other fluid, be injected by a small hole made artificially between the cellular covering and the subjacent muscular, or proper fibrous coat of the artery, the matter injected raises and elevates into a tumour, the cellular membrane which closely embraces the artery, without properly destroying its cells, which it fills and distends in a remarkable manner. If the matter which is injected be capable of coagulating, such as melted wax, and if it be pushed with much force, it is observed, that the cellular sheath of the artery is not only raised over it like a tumour, by the impetus of the injection, but the internal cells of that covering are also lacerated, and on examining afterwards the capsule of the artificial tumour, it appears as if it were formed of several layers, rough and irregular internally, smooth and polished externally. The same thing happens if air be pushed with much force, or any liquid substance capable of coagulating, within the artery, so that by the excess of the impulsion, the proper or internal and muscular coats burst at some point of their circumference; in which experiment, as in the first, the cellular sheath of the artery is observed to be raised after the manner of a tumour or aneurism. Nicholls[a] repeated this experiment several times before the Royal Society of London. 'If any one,' says he,

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[a] Philosoph. Transact. an. 1728, No. 402.

'wishes to convince himself of the truth of this fact, 'on the point of the different resistance of the coats of 'an artery, he will have the pleasure of seeing it proved 'by experiment: let him force air into the pulmonary 'artery, and of the two proper coats of the artery, the 'internal will be ruptured, while the external, which is 'not ruptured at all, will form aneurismal tumours 'over the artery.' The internal membrane of an artery, although thin, being, however, very compact and smooth, is that which opposes the greatest resistance to the impulse of the air, and prevents, more than any other, the bursting, or preternatural dilatation of the arterial tube. As soon as the internal coat of the artery is ruptured, the muscular coat is likewise ruptured, or is immediately torn, and allows the air, or any other fluid injected with force into the tube of the artery, to flow into its external cellular sheath. If, as Nicholls has likewise remarked, the muscular coat of the artery, and the cellular sheath which surrounds it externally, were of the same texture, the argument of those who think, that the muscular coat cannot be ruptured by the force of the blood, without the external cellular sheath being likewise torn, would have more force than it actually has; since, according to these principles, it would be possible, by approximation at least, to calculate the resistance of both of these coats, in proportion to their density, brittleness, or extensibility. But this cannot be done in the present question, and the error consists in this, that the resistance opposed by the muscular coat to the fluid, which having ruptured the internal coat, endeavours to pass through it, depends less on the different layers of its fibres and their density, than upon their brittleness, and the small degree of cohesion these muscular fibres have with each other; which degree of cohesion is certainly less strong than physiologists commonly suppose. On the contrary, the external cellular sheath of the artery, being of an interlaced texture, the thin laminæ of which it is composed, are not simply applied to one another, but reciprocally intermixed, reticulated, and connected in several ways closely together, although much less dense than the muscular or fibrous coat of the artery, yet it is capable, by yielding gradually to the impulse of the blood, of supporting great distension, without being torn or ruptured; points, which have been confirmed by observation and experiment.[e] On the contrary, the veins which want entirely, or at least have not any evident muscular fibrous coat, as the arteries have, if we except the great venous trunks in the vicinity of the heart, yield much more to the distension of the blood without being ruptured than the arteries do. It is wonderful to see in injections of the dead subject, to what degree of size the jugular veins yield, without being lacerated. The same happens likewise in the cava, the veins of the extremities, those which cover the prostate gland, the hæmorrhoidal veins, those of the gravid uterus, and those which surround the vagina. No artery of equal diameter could yield to such a degree of distension as a vein does without being ruptured. And since it is certain, that the principal difference, in the structure of the arteries and of the veins, consists in the veins having the internal coat more flexible and distendible than that of the arteries, and in the veins wanting entirely, or in great part, the rigid and brittle muscular and fibrous coat; therefore, it is easily understood, why, on account of the rigidity and brittleness of the proper arterial coats, and of the kind of contact which exists between them, the fibres of their muscular membrane are more disposed to be ruptured, from the violent impetus of the blood, than the veins, or the external elastic cellular sheath which surrounds the arteries.[f]

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[e] I have repeated the experiments of Nicholls several times, and always with the same success as the author had obtained.

§ 13. The phenomena which are observable in the artificial distensions of the thoracic or abdominal aorta, present themselves likewise, in my opinion, in the case of a morbid degeneration of the internal coat of the artery, during which, that coat becomes in some places weak, or very rigid and friable, and is thinned, separated, or ruptured, by the repeated jets of blood thrown from the heart. The internal coat of an artery being ulcerated or lacerated from a slow internal cause in some point of its circumference, the blood impelled by the heart begins immediately to ooze through the connections of the fibres of the muscular coat, and gradually to be effused into the interstices of the cellular covering, which supplies the place of a sheath to the injured artery, and forms, for a certain space, a kind of *echymosis*, or *extravasation of blood*, slightly elevated upon the artery. Afterwards, the points of contact between the edges of the fibres of the muscular coat being insensibly separated, the arterial blood penetrating between them, fills and elevates, in a remarkable manner, the cellular covering of the artery, and raises it after the manner of an incipient tumour. Thus, the fibres and layers of the muscular coat being wasted or lacerated, or simply separated from each other, the arterial blood is carried with greater force, and in greater quantity than before, into the cellular sheath of the artery, which it forces more outwards; and finally, the divisions between the interstices of the cellular coat being ruptured, converts it into a sac, which is filled with polypous concretions, and with fluid blood, and at last forms, properly speaking, the aneurismal sac; the internal texture of which, although apparently composed of membranes placed one over the other, is, in fact, very different from that of the proper coats of the artery, notwithstanding the injured artery, both in the thorax and in the abdomen, as well as the aneurismal sac, is covered externally, and inclosed within a common smooth membrane.

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[f] Walter Mem. de l'acad. de Berlin, an. 1785.

§ 14. In the very considerable number of aneurisms of the arch, and of the thoracic and ventral trunk of the aorta, commonly regarded by medical men as *true* or *incysted*, or as formed by a dilatation of the proper coats of the great artery,[f] which I have had an opportunity of examining, I have not found a single one, in which the rupture of the proper coats of the artery was not evident, and in which, consequently, the aneurismal sac was produced by a substance completely different from the internal or muscular coat of the injured artery. To ascertain the truth, and confirm the constancy of this fact, it is not necessary that one should be possessed of uncommon knowledge in the art of dissection, but only that he be disposed to see things as they really exist, and that he undertake to examine the aneurism in the situation in which it is found, and without removing the parts which surround it, or at least that he do this with due circumspection. For, as I have asserted above, very often the examination which is made by medical men, of internal aneurisms in the dead subject, consists of little more than a simple division of the fundus of the tumour, without paying attention to the cellular sheath which surrounds the artery, above and below the place of the aneurism, and without examining the disposition and particular characters of the proper coats of the aneurismatic artery, and comparing it with the substance which forms the parietes of the aneurismal sac; and what is still worse, the aneurism is examined by some, after being removed from the body, and filled with some substance, or dried; in which preparations, there is nothing to be seen but confusion and obscurity, in every thing which relates to the true nature and structure of the parts by which the tumour is formed.

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[f] See Appendix, note 2.

§ 15. A circumstance very important to be known relative to this subject, has been hinted at above; viz. that the aneurismal sac never comprehends the whole circumference of the injured artery, but only a portion of the arterial tube to which the tumour is united on the one or the other side. At this place, the aneurismal sac presents, as it were, a species of constriction, or neck, beyond which the sac of the aneurism is more or less enlarged, or expanded, and sometimes to an enormous degree.[c] This circumstance would never accompany aneurism, or rather, quite the contrary would be found, if the aneurismal sac were produced by an equable distension of the tube and of the proper membranes of the aneurismatic artery. For, in incipient aneurisms, at least, the greatest effect of the distension acting upon the tube of the artery, the greatest size of the tumour ought to be in the artery itself, or in the beginning or root of the tumour, and the least at its fundus. But observation demonstrates, that, whether the aneurism be recent and small, or of long standing and large, the passage from the artery is always narrow, and the fundus of the aneurism, the farther it is removed from the artery, the more it is enlarged. Another circumstance worthy of attention on this head, which I have likewise pointed out above, is, that the aneurismal sac is always covered by the same soft distendible cellular substance, which in the sound state surrounded the artery, and united it to the adjacent parts; which soft cellular substance, supposing it to be an aneurism of the arch, or of the thoracic trunk of the aorta, is covered by the pleura, and if the aneurism is in the abdomen, by the peritoneum, which membranes include the aneurismal sac, together with the ruptured artery, and presents externally, a continued, smooth, shining surface, as if the artery alone was in that way dilated.

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[c] The best plates which we have of internal aneurisms, represent the above-mentioned circumstance. See the figure given by Littre Mém. de l'acad. Royal de Paris, an. 1707, speaking of which aneurism, he adds; en se rabetant sur toute la partie superieure, anterieure de la poitrine, depuis une aisselle, jusqu' à l'autre, et en formant une poche assez semblable à une bouteille, dont le cou avoit été au dedans de la poitrine, et le fond au dehors.

See likewise Ruisch, fig. 38, annexed to his Observ. Anat. Chirurg. Obs. xxxvii.

§ 16. But if, instead of dividing, as is commonly done, the fundus of the aneurismal sac, the aorta be divided lengthwise on the other side, and opposite to the constriction or neck of the tumour, the place of the ulceration, or of the rupture of the proper coats of the artery, immediately appears within the artery, on the side opposite to that where the incision was made, and the fissure which has taken place is immediately discovered, the edge of which is sometimes fringed, often callous and hard, like that of a fistula; through which fissure the arterial blood had formed itself a passage into the cellular sheath of the artery, afterwards converted into an aneurismal sac. If, as sometimes happens in the arch of the aorta in the vicinity of the heart, the artery, before being ruptured, has suffered some degree of enlargement beyond its usual diameter, it appears at first sight that there are two aneurisms; but the constriction or neck which the aneurismal sac next to the artery presents externally, points out exactly the limits, beyond which the internal and muscular coat of the aorta had not been able to resist the distension, and have therefore been torn by it, and shews clearly the difference existing between an aneurism and a simple enlargement in diameter of the tube of the aorta in the vicinity of the heart.

§ 17. The rupture in the artery is always small in proportion to the large size of the aneurismal tumour; so that when the arch of the aorta has suffered some degree of dilatation before bursting, as sometimes happens near its passage out of the heart, on making an incision on one side into the aneurismal sac, and on the other into the tube of the artery lengthwise, two sacs present themselves, separated from each other by means of a partition or diaphragm lacerated in its middle; which partition is formed of nothing else than the remains of the internal and muscular coats of the ruptured artery. And as the limits of the proper coats of the aorta, and the beginning of the cellular aneurismal sac, are marked externally by that kind of constriction or neck which the tumour presents in the vicinity of the artery; in the same manner, internally, this partition, torn in its middle, determines the precise point of the rupture of the proper coats of the artery occupied by aneurism.

§ 18. All this acquires a degree of demonstration and certainty, to which nothing can be opposed, by carefully dissecting the proper coats of the ruptured aorta in its situation, and comparing them at the same time with the cellular substance forming the aneurismal sac; for, in the incision made in the direction of the axis of the aorta, and in its side opposite to that where the rupture has taken place, its proper coats are found either perfectly sound, or a little weakened and intermixed with earthy points, but still capable of being separated distinctly into layers from one another; when, on the contrary, in the opposite side of the aorta, where the ulceration or laceration exists, its proper coats are met with unusually thin, blended together, and with difficulty, or in no way capable of being separated from each other, intermixed very often with heterogeneous substances, which render them brittle like the shell of an egg; and lastly, disorganized and torn at the place where they form that species of partition, which marks the limits between the ruptured artery and the entrance of the aneurismal sac. Continuing to separate these coats from within outwards, we come to the cellular sheath which surrounds the aorta externally.[h] Then, on removing the cellular pulpy sheath of the aorta, it is found smooth externally, like the artery, villous, cellular, and irregular internally, extending from the circumference of the tube of the artery over the neck and fundus of the aneurismal sac. This external covering or sheath of the artery actually appears, to those who are not sufficiently skilled in such dissections, as if the artery were dilated under it to such a degree as to form the aneurism; and it has still more that appearance if the aneurism is very large and of long standing, since in this case the cellular sheath of the artery becomes unusually thick and pulpy, and because it adheres very firm-

[h] Pl. 1, *d d*, *e*, *f f f*.

ly to the subjacent muscular coat of the artery at the stricture or neck of the aneurismal sac. But even in these cases, as well as in those of recent and small aneurisms of the aorta, by employing care, we may at last succeed in separating, without laceration, this cellular sheath from the tube of the artery, above and below the injury, and successively from the subjacent muscular coat, as far as the neck or root of the aneurism.[1] It is then clearly perceived that the muscular coat of the aorta does not pass beyond the partition which divides its tube from the entrance of the aneurismal sac; and it is distinctly observed, that the fibres and layers of the muscular coat are not prolonged over the aneurismal sac, but terminate like a fringe, or in obtuse points, at the edge of the rupture of the artery. On which account, nothing can be more evident than that the aneurismal sac does not belong at all to the artery, and that, properly speaking, it is only the cellular sheath, which in the sound state covered and connected the artery to the neighbouring parts, which, being elevated by the effused blood, at first in the manner of an *echymosis*, then distended and compressed, has acquired that degree of density, and of additional hardness and thickness, as if it had been formed by the proper coats of the artery, prodigiously relaxed, distended, and thickened. These appearances the more readily lead to error, as both the injured artery and the aneurismal sac, as has been frequently mentioned, are covered by a common smooth membrane externally, such as the pleura in the thorax, and the peritoneum in the abdomen.

§ 19. The favourers of the contrary opinion do not deny that the artery is sometimes ruptured in internal aneurisms, but they only admit this in those cases in which the dilatation of the artery has been carried to a prodigious extent. The invalidity of this opinion appears to me to be clearly proved by the rupture of the artery being constantly met with, whether the internal aneurism be small or large, and the artery be a little, or, as most frequently happens, not at all dilated. And this opinion is likewise contradicted by its being now ascertained, that the internal and muscular coats of the artery terminate evidently in the fringe, or hard margin of the orifice of the partition, and that the aneurismal sac is not at all formed by the proper coats of the artery, but by the cellular sheath which surrounds it. In the large aneurisms in which the partisans of the common doctrine admit the rupture of the artery, a double rupture is always found, the one of the artery, the other of the aneurismal sac; and this last is that which actually kills the patient, by changing the aneurism from the *circumscribed* into the *diffused* state. The erroneous opinion, that the large arteries, and especially the trunk of the aorta, are as it were insulated, or covered only by a very fine membrane, adhering firmly to the subjacent muscular coat, and easily lacerated, has given rise in all probability to the belief, that the ulceration or rupture of the internal proper coats of the aorta could not take place, without this thin tense membrane covering the artery externally being likewise torn. Undoubtedly, if this were the case with regard to the external cellular sheath of the arteries, it would necessarily follow, that the blood should be effused into the thorax and abdomen, in every case of rupture of the abdominal or thoracic aorta. Indeed, we sometimes see this happen in practice, by the combination of some particular circumstances; for, if unfortunately the rupture of the internal and muscular coat of the aorta happens in such a point of the artery, where externally there is only a thin tense membrane closely applied to the aorta, instead of a corresponding soft cellular sheath, we see that this external thin membrane is likewise comprehended in the rupture of the proper coats of the artery, and that therefore sudden death takes place, from the inevitable effusion of blood into some of the principal cavities, especially the thorax. Such is the case whenever the internal and muscular membranes of the aorta are ruptured in that portion of the artery included within the pericardium, which is only covered by a thin reflected layer of it. In this particular circumstance of place and structure, as soon as the proper coats of the aorta are ruptured, this thin membrane is lacerated at the same time, and the blood is immediately effused into the cavity of the pericardium. An example of this kind is related by Walter, and illustrated by a figure;* by the Berlin Physicians;* and several other fatal accidents similar to these are recorded by Morgagni.* I have likewise observed a case similar to the preceding, the history of which I think proper to relate here. Joseph Varani, 22 years of age, a corporal of the 4th company of pioneers, while he was conversing cheerfully with his companions, was struck suddenly dead. This man, formerly by trade a shoemaker, had been repeatedly infected with lues venerea, and had also several times undergone a mercurial course. He had never, however, complained of difficulty of breathing, and his pulse had never been found irregular or intermitting, not even a few weeks before his death. On examining his body, the pericardium immediately presented itself quite distended with blood. The aorta in the vicinity of the heart, at the distance of half an inch above its valves, where it began to be incurvated, presented externally a tumour of the size of a nut, which opened by a small hole within the pericardium. The reddish, and, as it were, ecchymosed membrane, of this tumour diminished in thickness in proportion as it approached the place of the rupture, round which it was very thin. On making an incision into the concave part of the aorta, on the side opposite to the seat of the tumour, its internal coat, where it corresponded to the base of the tumour, was quite rough, corroded, interspersed with yellow hard spots, and actually *ulcerated* for the space of an inch in circumference. In the centre of this ulcerated tract, both the internal and muscular coats of the artery formed a slight pit, into which the point of the fore-finger could be introduced, so that any one, who had contented himself with the appearance of the parts, would have said, that this small tumour, which appeared externally on the beginning of the curvature of the aorta, was formed solely by the weakened and distended proper coats of the artery, or that this tumour was a *true* aneurism. But on removing carefully from the curvature of the aorta its external cellular sheath, and consequently the reflected lamina of the pericardium, leaving the subjacent fibrous coat untouched, I found that this reddish and ecchymosed sac was formed solely by the cellular sheath, and by the reflected lamina of the pericardium. This cellular capsule, at its base, adhered very firmly to the irregular edges of the ulceration, and rupture of the proper coats of the aorta, in such a manner that the limits of the one and of the other could be clearly distinguished. On which account, in this case there were two ruptures, as in all the others of sudden death caused by aneurism, the one in the proper coats of the artery, the other in its external cellular capsule. The thin, tense, reflected lamina of the pericardium, being provided with very little soft cellular substance under it capable of extension, when raised to the size of a nut, not being disposed to yield any further, burst,* and allowed the blood to escape into the cavity of the pericardium. But this is not the case in the other parts of the aorta, in its curvature without the sac of the pericardium, nor in its thoracic and abdominal trunks; through all which tract the cellular sheath of this artery, far from being a fine tense pellicle, adhering firmly to the muscular coat, as within the pericardium, is, on the contrary, a pulpy weak covering, allowing itself to be easily distended. Whence it happens that this cellular sheath is well fitted for yielding to the impulse of the arterial blood which is effused, and, by yielding, it allows itself to be formed into a sac, which strengthened internally by the addition of the polypous layers, and externally and anteriorly by the pleura in the thorax, and the peritoneum in the abdomen, opposes sometimes for a very considerable time the sudden fatal effusion of blood into these cavities.

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[1] Pl. 1, *fff, gg*.

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* See the Appendix, notes, No. 3, 4, 5,

§ 20. Of all the causes capable of producing the rupture in any part of the proper coats of the aorta, especially the internal, I have great reason to believe, that the slow morbid, *ulcerated*, *steatomatous*, *fungous*, *squamous* degeneration of the internal coat of the artery, has a share in it much more frequently, than violent exertions of the whole body, violent blows, or an increased impulse of the heart. The artery is nourished, and increases in the same manner as all the other parts of the animal body, it is vascular and organized, and therefore must be subject to the diseases, to which vascular and organized parts are liable. And it is a fact, of which no doubt can be entertained, that the proper coats of the aorta, and especially the internal coat, are subject from a slow internal cause, to an *ulcerated* and *steatomatous* disorganization, as well as to a *squamous* and *earthy* rigidity and brittleness.[k] Read upon this subject, what has been written by Bonetus,[l] Lieutaud,[m] Morgagni,[n] Haller,[o] Lancisi,[p] by Guattani,[q] Matani,[r] Borsieri,[s] Desault;[t] and farther, let any one skilled in the dissection of the human body, consult his own observation, and it will appear, that these morbid degenerations of the internal coat of the arteries are very frequent, especially in the curvature, thoracic, and abdominal trunks of the aorta. And this is not to be considered as a peculiarity of the coats of the artery; for, we have cases of *ossifications* of the pericardium, and of the heart, and of *steatoms* and *ulcerated* corrosions of the heart, from internal un-known causes.* The case of conversion of the coats of the aorta into a steatomatous tumour, related by Stenzel, and illustrated by figures, is very remarkable. *(Dissert. de Steatomatibus Aortæ*, 1723). 'Altera harum excrescentiarum,' says he, 'in angulo aortæ ubi incürvatur sita erat; altera vero aliquantulum ab hac distans descendentem occupabat ramum. Hæc corpora in tantam istum canalem molem extenderant, ut ipsum ferme cor magnitudine æquaret, omneque propemodum exeunti a sinistro cordis thalamo sanguini spatium præcluderet. Hi tumores, digitis admotis pressi, plane non cedebant, nullamque ob summam, qua pellebant duritiem foveam relinquebant; hinc unum de his incidendum, cultroque, atque examini anatomico subjiciendum esse necessarium ducebamus; quo dissecto et aperto, membrana satis crassa et firma, vitulino crassitie corio æmula, illo tamen adhuc durior, colore albicante ad incarnatum accedente prædita, striisque multis per totam superficiem notata oculis occurrebat nostris. In hujus cavitate materia quædam sebosa, et adipi perquam similis firmiter compacta inveniebatur.'

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* The pathological preparation mentioned here is preserved in the museum of this university.

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[k] Schulzius mentioned, that he had seen in a mare, the artery which runs along the colon, occupied by aneurism, the centre of which was full of small worms. Acta nat. curios. vol. i, obs. 219, p. 519. The tumour was of the size of a large nut, hard, and of an oval figure. A probe passed readily along within the artery, but at the place of the tumour, it seemed to pass through a ball of hair or wool. On opening the artery lengthwise, the author found, that its coats, at the place of the tumour, were three times thicker than natural. On examining the inside of the tumour formed by the thickened coats of the artery, he observed, that its substance was quite cellular, and that the cells were full of capillary worms twisted together.

[l] Sepulcret Anatom.

[m] Histor. Anatomico-med.

[n] See note in the Appendix, No. 6.

[o] De Aneurysmat. propos. 30, 31, 32.

[p] De extern. Aneurysmat.

[q] [r] [s] [t] See in the Appendix, notes No. 7, 8, 9, 10.

Crell, speaking of a state of hardness of one of the coronary arteries of the heart, remarks; 'exteriorem quidem tunicam nihil a statu naturali recessisse, sed duriorem intus nucleum recondere apparebat. Dissecto secundum longitudinem canale, interior ejus tunica, quam nerveam dicunt, integra manserat, transparente itidem per illam corpore alienæ indolis, coloris ex albo flavescentis, cujus majorem crassitiem circa ramorum imprimis e trunco egressum advertebam. Cum quale illud esset corpus durum, quave ratione illud pervenerit scire averem, atque omni ex parte arteriam versans, interiorem forte tunicam leniter comprimerem, materiem illi quæ in atheromate, vel meliceride alias continetur, similem, per poros ejus erumpere videbam, qua sub specie vermiculari expressa, maxima illius pars solidior, cæterum ejusdem coloris, intus remanebat, ut ex hujus induratione illam generatam esse, si diutius ibidem hæsisset, pariter exhalante parte tenuiore, coagulandam, dubitare non liceret.' *(Dissert. de art. Coronaria instar ossis indurata).* One of the most remarkable cases of ulceration of the internal membrane of the arteries, is published by Meckel, (Acad. de Berlin, 1756). 'Ayant ouvert l'aorte, je la trouvai à un pouce de distance de ses valvules toute ulcerée, extremement inégale, et déchirée. Les cavités étoient remplies partout de pus blanc, entre lesquelles étoient des parties non coherentes de la tunique nerveuse, qui flottoient librement.' The observation by Weitbrecht is equally deserving of being known, both on account of the fact, and the manner in which it is expressed, *(Comment. acad. Petropolitanæ,* t. iv). 'Cor igitur exscindo cum vasis adhærentibus summa cura, et apertis cavitatibus invenio corrosas, et tanquam a muribus exesas tunicas aortæ, immediate supra valvulas semilunares, et membranam adiposam, quæ vasorum e corde egredientium principia cingere solet, in regione sternum respiciente perforatam.' See farther, *Acta Medica Berolin,* dec. i, vol. viii, p. 86. Sandifort, in plate iii, annexed to his *Observ. Anatom. Patholog.* has delineated this sort of ulceration of the aorta, to which he adds: 'in hac etenim aorta ad omnia arteriarum intercostalium orificia, interna tunica tota consumpta erat, atque exesa, sic ut in omnibus illis locis de hac membrana nihil omnino superesset.'

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* Walter Mem. de Berlin, an. 1785. One of the most remarkable ossifications of the heart is delineated and described by Samuel Foart Simmons, in pl. vii, annexed to vol. i. of the Medical Communications, pag. 228.

But, as I have already mentioned, the *softening*, *ulceration*, and subsequent *rupture*, are not morbid states so peculiar to the arteries, as not sometimes also to attack the heart. Several examples of ulceration of the parietes of the heart have been recorded by Bonetus, (Sepulch. Anat.) Johnstone relates a case of softening, (Memoirs of the Medical Society of London, vol. i.), in which the substance of the heart was so dissolved and *putrid*, as he expresses it, that the point of the finger passed through it with the slightest pressure. Morand, (Acad. Royal des sciences de Paris, an. 1732), relates two cases of this kind, the one in the duchess of Brunswick, the other in a person of rank, who died the same year, from a rupture of one of the ventricles of the heart; on which subject he adds: 'Pour expliquer comment, dans le deux cas que j'ai rapportés les ventricules du coeur ont pû s'ouvrir sans cause exterieure, il faut remarquer, que dans le premier, il y avoit une erosion aux fibres charnues du ventricule droit, qui sembloient avoir été ulcereés, et creuseés peu à peu jusqu' au trou qui ouvroit le ventricule; et que dans le second la chaire du coeur étoit devenu molle au point, qu 'en quelque endroit qu'on presentat le bout d' une sonde, sans l'appuyer, elle entroit, et traversoit le coeur par le simple poids de l'istrument, qui n'ést pas considerable. Donc la rupture de cet organe sera raisonablement attribuée à l'amollissement de ses fibres, ou à un ulcere qui en aura usé l'epaisseur.' These diseases, which sometimes soften the substance of the heart, and dispose it to ulceration and rupture, are likewise common in the arteries.

§ 21. Lancisi mentions, that hypochondriac and scorbutic persons, hysterical women, and those who have been affected with lues venerea, are particularly predisposed to the *ulceration* and *disorganization*, (diloricatio), as he expresses it, of the proper membranes of the artery. Morgagni[t] has made the same remark. A great number of observations on this subject have successively confirmed this fact, and likewise demonstrated, that patients affected with lues venerea are, much more frequently than any others, affected with a *steatomatous*, *ulcerated* degeneration of the internal coat of the arteries. So great a disorder as the ulceration of a large artery ought certainly to be preceded by a state of disorganization, or of excessive relaxation of the artery, more particularly in the part corresponding to the seat or root of the aneurism, since aneurisms are observed to arise in persons, in whom it is impossible, in any way, to trace the origin to external violence applied to the artery, or to an increased impetus of the blood circulating in it. If the force of the circulation were capable of rupturing a great artery, aneurisms would be frequent in consequence of acute and violent fevers; and if a general relaxation of the whole body occasioned the rupture of arteries, aneurisms ought to be very frequent in dropsical patients, in those predisposed to paralysis, or in those in whom the bones become soft; in which patients, experience shews, that the contrary always happens.

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[t] Epist. xviii, art. 27. Nullus tamen dubito quin erodentia corpuscula eorum humores, qui lue venerea infecti sunt inquinantia, et in aliis etiam, quæ minime osseæ sunt, partibus subsistendo se produnt; sic et in arteriarum quoque tunicis non secus atque in scorbuticis, et hystericis, haud raro subsistant quas hic illic erodendo infirmant, atque dilatationibus obnoxias reddunt.

§ 22. But whatever be the state of this point, both of these morbid states of the artery always commence in the internal coat of the diseased artery, or in the space between it and the muscular coat, which in the sound state is filled by a very fine down, called by Haller the *cellulosa secunda* of the artery. At the beginning of the disease, the internal coat of the artery loses, for a certain space, its beautiful smoothness, and becomes irregular and wrinkled. It afterwards appears interspersed with yellow spots, which are converted into grains, or earthy scales, or into *steatomatous* and *cheese-like* concretions, which render the internal coat of the artery very brittle, and so slightly united to the adjoining muscular coat, that upon being merely scratched with the knife, or by the point of the nail, pieces are readily detached from it, and on being cut, it gives a crackling sound, similar to the breaking of the shell of an egg. This ossification of the artery cannot be said to be proper to old age, since it is sometimes met with in patients who are not much advanced in life. The whole of the side of the artery, in that part which is occupied by the morbid affection, is for the most part hard and rigid, sometimes soft and fungous, and, in most cases, the canal of the artery is preternaturally constricted. In the highest degree of this morbid disorganization, we find, on the inside of the artery, true *ulcerations*, with hard and fringed edges, fissures, and lacerations of the internal and fibrous coats of the artery. Some have thought, that, when this *steatomatous*, *earthy* induration of the coats of the artery happens, and produces a constriction of the canal of the artery, it contributes very much to the formation of aneurism above the place of the stricture, in consequence of the resistance which that stricture opposes to the blood sent from the heart. There appears to be some degree of truth in this opinion, with regard to the aorta at its origin from the heart, where, as I have repeatedly remarked, this artery shews a particular disposition to yield to an enlargement in diameter in its whole circumference; but the same disposition does not exist in its thoracic and abdominal trunks, nor in the arteries of the second order, such as the femoral and popliteal. In all the cases in which the stricture occurs in some point of the aorta, from below its curvature, as far as the iliac, and from thence to the popliteal artery, the aneurism constantly arises in the part where the *steatomatous, earthy* disorganization of the proper coats of the artery has occasioned the constriction of its tube. The aneurism occurs there, as I have demonstrated above, because the internal coat being *ulcerated* or *ruptured*, the blood oozing through between the layers of the muscular coat is effused into the cellular substance, which is raised in the manner of an *ecchymosis*, and is afterwards converted into an aneurismal sac. Morgagni[u] and Nichols[x] had occasion to observe the commencement of an aneurism under the appearance of echymosis, or extravasation of blood, which is a rare occurrence. In the history which the latter has given of the dissection of the body of George II, late king of England, he says, that he found a fissure in the internal surface of the aorta, through which a small quantity of blood had recently passed and formed an *ecchymosis*, pointing out the real state of an incipient aneurism of the aorta, and confirming a point of doctrine published by the same author, with regard to this subject,—that the external or cellular coat of the aorta can support the impulse of the arterial blood without being ruptured, although there be an ulceration, or laceration of the internal coat, which he calls ligamentous. Indeed, after due consideration of this matter, it cannot be otherwise: for, whenever the rupture or ulceration of the internal coat of the aorta is narrow, or of little extent, and deep seated, the blood which oozes insensibly through the muscular coat stops under the external cellular sheath, without raising it, exactly in the manner of an *extravasation*, or *ecchymosis;* but as soon as the quantity of blood collected there is capable of raising this external cellular covering of the artery, it is necessarily converted into a *pulsating* tumour, and aneurismal sac.

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[u] See § 19.

[x] Philosoph. Transact. vol. lii, an. 1761, part 1.

§ 23. Finally, there are not many descriptions and figures of aneurism of the aorta which are perfectly accurate. Nevertheless I shall point out the few examples of this kind with which I am acquainted, which will contribute very much to put in a clear light all that I have said with regard to the true nature and character of this disease, to which descriptions and figures I shall add some of my own. In the plates and figures, carefully delineated, I have remarked that the engraver, in copying exactly the object which he had under his eye, has proved the contrary of what the author has written on the same subject, of which we have several other examples in anatomy.

§ 24. In Lancisi[s] we read the following account of the dissection of an aneurism of the aorta. ‘ Extractis cruoris grumis, in cystidis fundo foramen spectavimus apertum in facie antica summitatis arcus arteriæ magnæ, parumper deorsum inclinatum. Erat autem foramen fere rotundum, æqualemque habebat diametrum ei monetæ, quæ vulgo appellatur *un Giulio.* In ejus vero foraminis circumferentia callus quidam durus supereminebat, ea tamen lege, ut in situ magis declivi eadem durities esset complanata, et fere horizontalis cum interiore superficie sacculi aneurismatici.' After the explanation which has been given in this chapter, it is easy to understand, that this aperture, equal in circumference to a *Julio** observed by Lancisi in the bottom of the aneurismal sac, was the rupture which had taken place in the internal and muscular coats of the aorta, and that the elevated hard margin was the partition, or the boundary between the proper coats of the aorta, and the beginning of the cellular aneurismal sac.

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[s] De Aneurysmat. propos. xxii.

§ 25. Dr. Pierce Dod[b] mentions, 'We found, on 'opening the thoracic aorta, that this artery had retained its natural diameter. But continuing to divide the artery from below upwards, as far as the 'origin of the right subclavian, (which was nearer than 'usual to the beginning of the left carotid), we found 'a preternatural circular opening in the aorta, about 'half an inch in diameter. On carrying the incision 'through this aperture within the aneurismal sac, we 'observed that its edges were hard, and almost cartilaginous, and seemingly the remains of the fibres of 'the muscular coat of the artery. Upon a nicer inspection, we found, in fact, that these remains were 'fibres torn from the muscular coat of the aorta, 'which, terminating here, the aneurism immediately 'increased to two inches in diameter, and continued

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* A Roman coin, about the size of a shilling.

[b] Philosoph. transact. an. 1728.

'to enlarge the farther it proceeded towards the clavicle and neck. The tumour was covered by the external membrane of the artery, which had yielded to the prodigious distension without being ruptured.'

§ 26. The celebrated surgeon Palletta[i] has given the detail of what he found in the bodies of two men, who died of aneurism of the aorta, which I shall relate in his own words.—'On dividing the integuments, and separating them from the chin to the umbilicus, and from the lateral parts of the tumour, a great ulcerated cavity was observed, and the whole superior part of the first bone of the sternum and sternal extremity of the clavicle were carious. On removing the sternum, a tumour of prodigious size immediately presented itself, which extended into all that space, from the heart upwards, occupied by the lungs as far as the pharynx, of an extraordinary hardness, and covered by the mediastinum and pleura, and it also formed several projections forwards, the greatest of which at the upper part, having become visible externally, pulsated above the edge of the right clavicle. The right cavity of the thorax contained a yellowish fluid, with some membranous concretions spread over the lung. In the left, the lung had contracted a firm adhesion with the pleura; these two viscera being in other respects sound. The superior and external part of the tumour, which was ulcerated, communicated with the cavity of the aneurism, and the exit of the fluid blood was prevented by the polypous concretions which it contained. The carotid arteries (although the right

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[i] Giornale di Venezia an. 1796. Aprile No. iv.

‘ was at first conceived to be morbidly dilated) were ‘ in their natural state. The vena cava remained ‘ pervious; not so the external jugulars; especially ‘ the left, which in passing over the tumour was ‘ completely obliterated near its origin from the subclavian. The right, on the other hand, had become very large, and flattened. From the external parts we proceeded to the internal, and on dividing the pericardium, the coats of which were ‘ much thickened, it was found full of a reddish ‘ lymph, in greater quantity than usual, and its internal surface was covered by thick floating flakes; ‘ the heart also, not increased in size, was covered ‘ by these flakes like fringes, which also surrounded ‘ all the origin and termination of the great blood-vessels. It was an aneurism of the aorta, formed ‘ in the middle space between the origin of the subclavian artery, and the sigmoid valves. One would ‘ have conceived that the artery was enormously dilated, the whole aneurismal sac was so smooth and ‘ solid. However, on opening the artery from its ‘ beginning to the arch, at the place internally where ‘ it forms the great sinus, a round aperture appeared, ‘ of the size of a twenty-penny piece,* and blocked ‘ up by a thick fibrous coagulum. Along the sinus of ‘ the aorta another coagulum was found, in the form ‘ of a polypus, partly red, and partly white. The artery was not dilated; the whole of its surface had ‘ that appearance of health and strength which is observed in the sound arteries. All the blood which ‘ filled the aneurismal sac had passed by the artificial hole into the neighbouring cellular substance ‘ under the pleura, and had distended it in such a ‘ manner as to resemble a *true* aneurism.’

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* Nearly as large as a halfpenny.

The other history relating to this subject, mentioned by this celebrated author, is equally accurate and interesting.—'I observed,' says he, 'not long 'ago, a spurious internal aneurism in a man, in 'other respects well made, and of a good constitu'tion. He fell upon his back, and after the fall a 'fixed pain arose on the left side of the spine, near 'to the first false ribs. The pain increased, and was 'accompanied by a pulsation, which continued till 'his death. It happened suddenly, as is usually the 'case in such affections, and the left cavity of the 'thorax, on being laid open, was seen filled with 'blood and serum. On raising the lung, the aneu'rismal sac immediately presented itself, lying upon 'the vertebral column, of an oval figure, which might 'actually have been taken for a *true* aneurism, and 'might have been supposed to have burst at the in'stant of death, as the rupture was evident, through 'which all the blood collected in the thorax had 'been discharged. But this supposed state was as'certained to be a *false* aneurism; for, on dividing 'the aneurismal sac, and separating it a little from 'the spine, the descending thoracic aorta was ob'served to be of its natural size, and sound, except 'a hole capable of admitting a pea, formed lateral'ly, and at the upper part of its tube, and there'fore it did not correspond to the aperture in the 'aneurismal sac, towards the left cavity of the tho'rax. This sac was formed by the pleura, greatly 'distended, which had at last burst, and left no room 'for doubt that the aneurism, from its very com'mencement, was not of the kind denominated *false*, 'or in other words, an aneurism arising from the 'rupture of the artery at the time of the fall.'

§ 27. I found a state of parts very similar to this in the aneurismatic patient from whom I have taken fig. 1 and 2 of pl. ix; * the history of which I shall here relate. Pasqual Castiglioni, 45 years of age, of a stout but slender habit of body, addicted to the pleasures of wine and women, having served 25 years in the Austrian army, came to this hospital the 5th of November 1801. He said, that he had been subject, for about six months, to almost constant pains in the lumbar region, stretching over the abdomen.‡ The pains were more violent during the night than in the day time, and were accompanied by difficulty of breathing, languor, and ardor urinæ. The urine was quite cloudy, of a dark red colour, with a chalky sediment, and in the moments of greatest spasm the tension and weight extended to the testicles, especially to the left. For four months after the attack of pain, this patient had not had recourse to any method of cure, but trusting entirely to his own knowledge, took some rhubarb and diuretics, and had his loins stung with nettles; after which, for eighteen days the diurnal pains seemed to him to have been rather relieved. The pains recurring again, he put himself into the hands of a physician, who conceived the disease to be rheumatism; in consequence of which, he made him apply blisters, and use sudorific decoctions, which only caused a greater exacerbation of his disease. Another physician was consulted, who supposing that there were calculi in the kidneys, prescribed for him the volatile liniment,

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* See plate 1 of this work.

‡ See a case very similar to this described by Sir John Pringle, Essays and Obs. Physical and Literary, of Edinburgh, t. iii, p. 200; ibid. Monro, case x, pag. 225; Walter. Mem. de Berlin, an. 1785, p. 56. tab. i, ii.

soap pills, and emollient decoctions, but all without any advantage. Indeed, there were none of the proper symptoms of nephritis present. A fixed pain extending to the left lumbar region; an almost continual restlessness; a regular pulse; no fever; no vomiting; the lower extremities sometimes quite cold, while the upper extremities, and especially the head, perspired copiously, from the violence of the pains, which attacked him for the most part in the afternoon, or during the night, and extended to the left lower false ribs, to the loins, to the left thigh, and sometimes to the left testicle. These pains were more acute in rainy or windy days, than in serene weather. Opium alone, in large doses, combined with assafœtida, and gentle friction with oil of amber, procured him some relief. The patient preferred lying on his left side, or bent forwards when he sat up in bed. No pulsation was felt in the left lumbar region, either by the patient or by the assistants. This unfortunate man, in the morning of the 15th February 1802, was found dead in his bed, lying on his left side.

On opening the abdomen, and removing the intestines, there appeared along the left lumbar region, as far as the crural arch of the same side, a black coloured swelling, apparently gangrenous, which appearance was however only caused by black extravasated, coagulated blood behind the peritoneum. On examining the aorta from the heart downwards, in its proper situation, when I came to about eight fingersbreadth before the thoracic aorta passes under the crura of the diaphragm, the aneurism presented itself resting on the bodies of the lower vertebræ of the back, and I then ascertained the true nature of the disease.

Having evacuated this great collection of extravasated grumous blood from the abdomen, by which the peritoneum had been raised from the appendices of the diaphragm, as far as the left crural arch, I remarked that the effused blood had formed deep excavations in the substance of the left psoas muscle, so as to disorganize the lumbar nerves, and injure the *anterior crural* and *obturator* nerves. This accounted for the very acute pains felt by the unhappy patient in these parts, and for the sense of coldness which he experienced in them. From these deep pits, which had been filled with grumous blood, my fingers passed freely behind the peritoneum, between the appendices of the diaphragm within the thorax, behind the pleura, and from thence into the cavity of the aneurism, which rested, as I have said, upon the inferior vertebræ of the back, and was full of grumous blood. The thoracic aorta, examined on its anterior surface, seemed to pass over the aneurism, without having any share in the formation of it; and the more so, as this artery had preserved its natural diameter in its whole course. I submitted the particular conformation of this aneurism to a careful examination. Having raised the pleura which covered the trunk of the thoracic aorta, as well as the aneurism anteriorly and laterally, a thick pulpy cellular substance presented itself under the pleura. Having separated slowly the cellular sheath which surrounds this artery in the natural state, all round the thoracic aorta, for a considerable way above and below the aneurism, I saw plainly that it was this pulpy cellular substance, this natural external sheath of the artery, quite distinct and capable of being separated from the subjacent muscular coat, which being raised by the effused arterial blood, had been converted into an aneurismal sac.[d] Having then made a longitudinal incision into the thoracic aorta, on its anterior surface, and in that space where this artery seemed to run uninjured over the aneurism, there immediately appeared opposite to the incision, or in the posterior side of the artery, a rupture a little more than an inch in diameter, with irregular, hard, callous edges; through which rupture my finger passed into the large aneurismal sac. The tube of the thoracic aorta was not at all dilated at the place of the rupture. The edges of the laceration still preserved the characters of the proper coats of the artery, especially of the muscular coat, and there was an evident difference, at the edges, between the truncated extremities of the fibres of the muscular coat, and the beginning of the cellular pulpy aneurismal sac,[e] over which, as I have mentioned, the pleura extended, as well as over the trunk of the thoracic aorta. Having then turned the thoracic aorta along with the aneurism, from the left to the right side of the vertebral column,[f] I found that the aneurismal sac, on the side next to the bodies of the inferior vertebræ of the back, was wanting for a certain space, and that there the place of the sac was supplied by a portion of the bodies of the dorsal vertebræ, partly corroded, with the exception of the intermediate cartilages, which, as other surgeons have remarked, remain in similar circumstances, uninjured longer than the bony substance. On examining attentively the internal surface of the posterior part of the aneurismal sac, or that which was next to the vertebral column, there appeared in the bottom of the sac, a rent, or passage from the posterior side of the thoracic aorta into the aneurismal sac, and this posterior side of the artery,

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[d] Plate 1, *d d*, *e e*, *f f f*.

[e] Plate 1, *g g*, *f f f*.

[f] Plate 1, *g g*, *f f*.

resembling a partition[a] perforated in its middle, marked the boundaries between the proper coats of the artery, and the beginning of the cellular aneurismal sac. The trunk of the thoracic aorta, examined also on its posterior surface, was not at all dilated beyond its natural diameter. Its internal coat, round the place of the rupture, had lost its natural smoothness, and was here and there covered with earthy scales, and ossified points; which appearance was also observed in this patient, on the internal coat lining the curvature of the aorta, in the vicinity of the heart.

§ 28. In addition to what has been explained in the preceding case, I shall now add the following history. The patient was a shoemaker, who had for a long time had a pulsating aneurism, which protruded outwards on the right side of the thorax in the interspace of the upper true ribs. The tumour had pulsated strongly till the death of this unfortunate man, which happened unexpectedly. He had said, that the cause of his disease was the constant percussion of the leather against his breast in working. On opening the body, I found that the aorta, which was scarcely more dilated than usual, was evidently drawn from the left to the right side, and that it, together with the large aneurismal sac, had so much contracted the cavity of the thorax, that the right lung was rolled up, and appeared as if a great part of it had been wanting. The aneurismal sac was united firmly to the upper part of the pericardium, and at the point of firmest union between these parts a rupture had taken place, through which the blood of the aorta had been poured in great quantity into the pericardium, and had occasioned the sudden death of the patient. The aneurismal sac, by its long pressure against the upper true ribs of the right side, in the vicinity of the sternum, had caused a corrosion of some of these ribs. To ascertain, however, completely the nature and intimate structure of this aneurism, I began by removing from the arch of the aorta its natural cellular sheath from below upwards as far as the root of the aneurism, so as to lay bare the muscular coat of the arch of the aorta in all this space. Having done this, I made an incision into the artery lengthwise on the side opposite to the root of the aneurism. I then discovered within this artery, on the opposite side, the place of the rupture of its proper coats; which rupture was surrounded by an irregular callous margin, as is usually observed in a fistulous opening. This portion of the side of the lacerated artery appeared to be in fact a partition ruptured in its middle, and placed between the cavity of the artery and that of the aneurismal sac. The ruptured fibres of the muscular coat of the arch of the aorta evidently terminated in the margin of this rupture. Continuing then to separate carefully the natural cellular sheath of the curvature of the aorta, and separating it from the subjacent muscular coat, there could be nothing more evident than that this cellular sheath was the same which was converted into an aneurismal sac, covered anteriorly by the pleura, and for a certain space also by the upper part of the pericardium, with which the sac had contracted a firm adhesion. Having opened the aneurismal sac anteriorly, or on the side, which was beginning to protrude out of the right side of the thorax, there appeared evidently within the cavity, and at the root of the sac, the rupture of the proper coats of the artery, and there was a very marked difference between the cellular pulpy texture of the aneurismal sac and the fibrous structure of the partition, lacerated in its middle, and quite peculiar to the artery. The internal coat of the curvature of the aorta, especially on the side of the rupture, was interspersed with yellow specks and earthy scales, which had rendered it at that place rigid and brittle.

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[a] Plate 1, *gg*.

§ 29. With regard to the figures and plates of aneurism of the aorta, I shall point out here, for the convenience of students, those few figures which appear to me to have best expressed the truth of what I have explained. The first design of an aneurism of the aorta which was published, as far as I know, is that of William Riva,[h] which, although roughly delineated, shews nevertheless plainly enough the proximate cause of this disease. For it represents the aneurismal sac divided by an incision through its fundus and neck, as far as the arch of the aorta; and under the letters H H is distinctly seen the place of the rupture of the proper coats of the artery, and at the same time that species of partition perforated at its centre, formed by the side of the lacerated artery, which points out the exact boundary between the ruptured artery, and its cellular sheath converted into an aneurismal sac.

§ 30. In the figure published by Dr. William Hunter,[i] of an aneurism of the arch of the aorta, the sac of which had been divided in the vicinity of its neck or root, the boundaries of the rupture of the aorta, and the beginning of the cellular sac of the aneurism, are distinctly seen. This author, who, with many others, was of opinion, that the aneurismal sac was only the dilated artery, found himself not a little embarrassed when he undertook to explain how the aneurismal sac in the vicinity of the arch of the aorta had a sort of stricture or neck, and the more so, that of five aneurisms which he had had an opportunity of observing, four had this stricture.[k] He said, that this neck or stricture was occasioned by the resistance which the fundus of the aneurismal sac had met with against the sternum, by which the whole tumour had been flattened. In saying so, Dr. Hunter shewed that he did not know that the same form is presented by aneurisms which beat against bones, as well as by those which do not, and that the aneurisms of the common trunk of the carotid and right subclavian arteries,[l] which do not beat against any hard body, have likewise a neck, or a sort of stricture. If Dr. Hunter, instead of examining aneurisms of the arch of the aorta out of their situation, and dried, as he was accustomed to do, had dissected them *in situ*, and in a recent state, and had at the same time separated and compared the proper coats of the injured artery with the substance composing the aneurismal sac, he would not so easily have allowed himself to be deceived, by seeing that the artery, as well as the sac of the aneurism, were covered by a common smooth membrane, or by the pleura;[m] and he would have ascertained, that this neck, or stricture at the root of the aneurism, was nothing but the boundary between the proper coats of the lacerated aorta, and the beginning of the cellular aneurismal sac, which, from mechanical necessity, was obliged at this place to assume the above described form.

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[h] Acad. nat. cur. An. i, Decad. i, Obs. xviii.

[i] Medical obs. and inquiries, vol. i, pl. iv, fig. i. G G.

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[k] Loc. cit. In four of the five cases that have fallen under my examination, it was very plain that the anterior part of the curvature of the aorta was protruded into a sacculus, with a stricture between it and the rest of the aneurism. Here, I presume, the arterial coats must have been weakened by pressure, and the resistance of the sternum and ribs must have made the protruding part swell out in its lateral circumference. Whence a stricture between this sac and the rest of the aneurism, and the appearance of the whole as of a double aneurismal sac, one part communicating with the other by a narrow orifice. Pag. 343.

Loc. cit. Pl. i, fig. iv, vol. iii.

§ 31. A very marked example of this is furnished by the figure of an aneurism communicating with the common trunk of the carotid and subclavian, described and delineated by Bayford.[n] The small tumour was large at its fundus, and constricted at the root, where it began to go off from the artery. On opening the artery lengthwise, on the side opposite to the seat of the small aneurism, it was found that the hole of communication between the tube of the artery and the aneurismal sac was little more than three lines,[o] while the fundus of the tumour was about two inches in diameter. This hole was produced by the rupture of the artery, a portion of the coats of which formed internally a kind of partition between the artery and the aneurism, and externally that appearance of stricture or neck which was observed at the root of the aneurismal sac. The same author has likewise given the description and an accurate figure of an aneurism of the ruptured abdominal aorta,[p] in which case he remarks, that the artery was not at all dilated beyond its natural diameter.

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[m] Loc. cit. vol. i. That this peculiar sac was not formed in consequence of a rupture in the artery at that place, was plain from the different degrees of it in these four different cases, as well as from an obvious continuity both of the surface and substance of the artery in all of them. Pag. 344.

[n] Loc. cit. vol. iii. pl. i, fig. i, iv, v.

[o] Loc. cit. pl. iv, fig. v.

[p] Loc. cit. pl. i, fig. ii, fig. ii and iii.

§ 32. Mr. Thomson has published the figure of an aneurism of the arch of the aorta,[q] which deserves to be considered with attention; for, it represents in the same preparation the two distinct affections of the artery immediately after it passes out of the heart, that is, the equable enlargement in diameter of the whole tube of the artery,[r] and that which, properly speaking, constitutes aneurism. This figure besides shews, in the most distinct manner, the stricture or neck,[s] which is invariably presented by the root of the aneurism in the boundary common to the proper coats of the ruptured artery, and to the beginning of the cellular aneurismal sac.

§ 33. The figures published by Roloff,[t] Verbrugge,[u] and Guattani,[x] likewise represent accurately the curvature of the aorta, and at the same time the aneurism, which takes its origin not from the whole circumference of the arterial tube, but from one side of the artery only. In some of these figures of the aneurism of the arch of the aorta in the vicinity of the heart, the complication of the increased diameter of the whole canal of the artery is marked, in others it is not; for such is the nature of the case; because aneurism often exists without any previous dilatation of the arterial tube, and because, if we except, as I have several times mentioned, the curvature of the aorta in the vicinity of the heart, in which situation only this complication of an enlargement of the arterial canal in diameter and of an aneurism* sometimes happens. In the rest of the aorta, from its curvature downwards, the aneurism always takes place without any evident dilatation of the tube of the artery. In all the above-mentioned figures, there may be distinctly perceived the limits between the proper coats of the lacerated artery, and the beginning of the cellular sac of the aneurism.

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[q] Loc. cit. vol. iii, pl. ii.

[r] Loc. cit. F.

[s] Loc. cit. G.

[t] Acad. R. de Berlin, an. 1757.

[u] De Aneurysmate, Tab. v.

[x] De extern. Aneurysm. Tab. ii, fig. i, ii. Tab. iv, fig. ii.

§ 34. Marcot,† in the description which he gives of an aneurism of the aorta, eight inches below its origin, says, that the tumour was about the size of the fist, but that the aperture of communication between the trunk of the aorta, and the aneurismal sac, was not more than fifteen lines in length, and eight in breadth. Notwithstanding the great difference of size of the tube of the aorta, compared with the aneurismal sac, and the smallness of the aperture, by means of which the aorta communicated with the sac of the aneurism, this author was of opinion, that the aneurism was formed by the dilatation of the coats of the aorta. Figures 1, 2, 3, 4, subjoined to his memoir, prove precisely the contrary of what the author has asserted; that is, that the aneurismal sac did not belong at all to the artery. I am very desirous that my readers should compare all, or at least the greatest part of the figures of aneurism referred to in this and the preceding paragraphs, as I am certain, that the inspection of the figures pointed out, will contribute very much to render more plain, what I have proposed to demonstrate with regard to the true nature, and proximate cause of this disease.

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* Walter, Mém. de Berlin, an. 1765. D'autant plus, que les membranes de l'artére pulmonale, et de l'aorte sont plus déliées, et plus molles à proportion de ce qu'elles sont plus voisines du coeur, ce qui les rend plus faciles à ceder, et à s'elargir. C'en est assez pour faire comprendre non seulement comment les anéurismes existent plutôt dans ces endroits que partout ailleurs, mais encore pourquoi ils y acquierent le plus de grosseur.

† Mém. de l'acad. R. des sciences de Paris, an. 1724, p. 414.

§ 35. Whenever an aneurismal sac of an immoderate size beats violently, and for a long time against a bone, as the sternum, ribs, clavicle, and vertebræ, it invariably happens, that the bones are in the end corroded, so that the aneurismal sac elevates the integuments of the thorax, or of the back, and pulsates immediately under the skin. To explain this phenomenon, some writers have had recourse to the abrasion of the bones, occasioned by the afflux and reflux of the arterial blood within the cavity of the aneurismal sac; others have thought, that it was the effect of a power of dissolving the bones, or of a *bone-dissolving* quality, existing in the blood. But both these theories are, in my opinion, unsatisfactory; because the bloody coagulated layers which form at an early period, and continue incessantly to accumulate one above the other, from the circumference to the centre of the tumour, prevent the bones from coming in contact with the fluid blood, and remove them from it; and because this *bone-dissolving* quality attributed to the blood, is by no means proved by certain or direct experiments; the contrary even appears to be the case, from the observations made by Sir John Pringle, with the intention of ascertaining it. There are numerous examples of extravasated blood remaining stationary, and in contact with the bones, without either the soft or the hard parts having received any injury from its presence, whenever there had not occurred a strong pressure caused by the extravasated blood on the soft parts, and on the bones. Else[x] relates the case of a man, who, in consequence of a violent contusion, had for more than two years, a great extravasation of blood, which extended from the axilla along the inner side of the humerus, as far as the elbow. This man having died of a quite different disease, it was found in the dissection of his body, that this vast effusion of blood had been formed by a rupture of one of those *deep* seated veins, which accompany the brachial artery. The blood had been for a long time in contact with the bone of the humerus, and surrounded the brachial artery; nevertheless, the humerus remained uninjured.[y] And although some, as happened to Sandifort,[z] have contracted ulcers in their hands in making the dissection of large aneurisms protruding out of the thorax, and which had already passed into the state of gangrene, it would not be lawful to infer, that an ichor so pungent, as to ulcerate not only the soft parts, but the bones also, flowed out of the blood contained in the cavity of the aneurism. It is evident, that in this case, the causticity is to be referred to the state of putridity produced by the gangrene, not only in the bloody clots contained in the tumour, but in the substance composing the aneurismal sac, and in the parts with which it is in contact. Every doubt on this subject is more particularly removed, by the fact of corrosions being produced in the bones by the aneurismal sac, though it remained entire on that side which rested upon, and compressed the bones. Ruysch relates two of these cases in his anatomical observations; and Du Vernoy has inserted in the acts of Petersburg, the case of an aneurism of the aorta, which had produced excavations in the vertebræ, though they were still found to be covered by a membrane. And Vacca, in a history which he has published of a popliteal aneurism, operated upon by Mr. Hunter's method, mentions, that he found, fifty-two days after the operation, that the parietes of the aneurismal sac were almost every where approximated and united; that the sac was uninjured on the side which rested upon the posterior surface of the tibia near the head of that bone; but that, notwithstanding, on removing the sac, the bone was found to be carious behind it.

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[x] Medical Obs. and Inquiries, vol. iii, p. 172.

[y] See Appendix, note 11.

[z] Nova acta acad. Cæs. Leopold. t. iv, p. 31;

§ 36. The explanation which, to me, seems the most plausible, of this phenomenon, is that which is drawn from the analogy of other phenomena similar to this, and which we see frequently occur in the living solid, by means of the increased activity of the *absorbent lymphatic system.* It is a certain fact, proved by innumerable observations and experiments, that in order to excite and increase the activity of the absorbent lymphatic system, and to raise it to so high a degree, as to obtain by means of it, the destruction of a certain portion of the solid parts of an animal, it is sufficient to compress the parts which we wish to be absorbed with such a degree of force, especially from within outwards, that the compressed parts be thereby deprived of a considerable part of their natural vitality, and of their usual nourishment, so that in this respect the compressed parts are, to use the expression, inferior in vitality to the contiguous parts possessed of their full nutrition and vitality.[*] The absorbent lymphatic system, which might, not without reason, be called the system of destruction of the animal body, and which would be so in fact, if the individual parts of the animal were not constantly renewed by the arterial system, absorbs continually and rapidly, and at every point, the particles of the compressed parts, having little or no nourishment, in comparison with the contiguous parts, and deprived of that degree of vitality, which enabled them to resist the destruction. The mouths, therefore, of the absorbent vessels, produce in the compressed parts, a solution of continuity, and a destruction of substance proportioned to the extent, depth, and force of the compression, and to the deficiency of nourishment and vitality, which these parts previously received from the arterial system. It is from this circumstance, that we see the skin absorbed, or, which signifies the same thing, become ulcerated for a certain space, in consequence of a long continued recumbent posture; that we see every day parts become corroded and ulcerated, from an ill applied, and too tight bandage; that we observe foreign bodies pushed by the force of nature from within the animal body towards the surface, by pressing on the parts which surround them, causing them to be absorbed or ulcerated, and thereby making themselves a passage through them outwards; that the matter of abscesses although by nature not caustic nor corrosive, by pressing the skin, and elevating it greatly in some poin causes the skin at the part of the greatest pressure, t be absorbed by the lymphatic system, or ulcerate and allows the matter to be discharged; that incyst tumours, such as the *melicerous*, *atheromatous*, *ste tomatous*, the *lupiæ*, and *fungous* tumours of the du mater, the contents of which no person has hithe demonstrated to be possessed of a caustic, and still l of a *bone-dissolving* quality, by the long pressure upon the bones, at last occasion a portion of them to be absorbed, and thereby a cavity to be formed in the bones, into which a portion of this incysted tumour insinuates itself; and many other facts of this kind, which I omit mentioning. Now, if this is a fact, proved by the attentive observation of the phenomena of the animal economy, and by daily experience in surgery, it is no longer, in my opinion, obscure, why the aneurismal sac, having acquired an immoderate size, so as to press strongly against the bones, should be capable, by its pressure alone, of occasioning the excessive absorption, and consequently, the destruction of a portion of the bones on which it presses, and of forming itself a passage through the substance of these bones. For, as soon as the aneurismal sac, by the force of the heart, and by the firm collection of grumous and polypous blood, is pressed strongly against the sternum, ribs, clavicle or vertebræ, the point of contact upon which the greatest force of the pressure falls, loses its natural nourishment and life, and thence, both the compressing portion of the sac, and the compressed portion of the bone, are subjected to absorption and destruction. The lymphatic system, therefore, absorbs all the compressed, weakened, and atonic substance, (no longer in a state of being repaired by the arterial system), both of the aneurismal sac and of the bones; in the latter there are formed deep excavations through their whole thickness, so that, at last, the coagulated blood of the aneurism, having passed through the bony substance of the sternum, ribs, or vertebræ, is raised below the integuments, and there forms a *pulsating* tumour. This being the state of the parts, the same destructive process is renewed in the soft parts which cover the tumour externally; I mean the muscles and the common integuments. For, the coagulated clot of the aneurism, having passed through the substance of the bones, continues to press the muscles and skin as before, from within outwards, and these parts, at the point of the greatest pressure, are thereby deprived of the due degree of nourishment and life, which is necessary in the living solid, to enable it to counterbalance the power and the destructive effects of the absorbent system. The absorbent lymphatics, therefore, as they have done in the bony substance, attack, consume, and ulcerate the muscles and integuments, and carry the ulceration so far, as to render the skin very thin, so that it at last bursts, and occasions a fatal hemorrhage. In cases of this kind, in which the surgeon, by means of spiritous and strongly stimulant applications, succeeds in hardening, in the manner of dried leather, the thin and dead portion of integuments opposite to the point of the greatest pressure made by the clot of the aneurism, the lymphatic system turns its destructive action no longer upon the dead portion of integuments, but upon the edges between the hard coriaceous eschar, and the living skin, from which it detaches the eschar all round, forming a deep furrow of separation; and then, on the bursting of the aneurism, the coagulated clot rushes out with a circular piece of hard coriaceous integuments adhering to its upper part. In the bodies of those who have died from the effects of this formidable disease, the attentive examination of the excavation formed in the bones of the sternum, ribs, clavicle, or in the bodies of the vertebræ, has clearly shewn, that no part of this was to be ascribed to the moist caries, nor to the acrimony of the coagulated clots, or of the fluid blood; and that there were only distinctly observed, the usual marks of the absorption caused by the mouths of the lymphatic vessels; that is, these excavations were similar in some measure to the knawing of moths.

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[*] It appears to me, that the author has taken this explanation of the progressive absorption of the parts covering the aneurism of the aorta, from Mr. J. Hunter's Treatise on the Blood, Inflammation, &c. p. 439, chap. vi, of ulcerative inflammation. *T.*

§ 37. From all that has been hitherto said with regard to aneurism in general, and more particularly of that of the aorta, it appears to me, that we may with certainty conclude, 1st, That this disease is invariably formed by the rupture of the proper coats of the artery. 2dly, That the aneurismal sac is never formed by a dilatation of the proper coats of the artery, but undoubtedly by the cellular sheath which the artery receives in common with the parts contiguous to it; over which cellular sheath the pleura is placed in the thorax, and the peritoneum in the abdomen. 3dly, That if the aorta immediately above the heart appears sometimes increased beyond its natural diameter, this is not common to all the rest of the artery, and when the aorta in the vicinity of the heart yields to a dilatation greater than natural, this dilatation does not constitute, properly speaking, the essence of aneurism. 4thly, That there are none of those marks regarded by medical men as characteristic of aneurism from *dilatation*, which may not be met with in aneurism from *rupture*, including even the circumscribed figure of the tumour. 5thly, That the distinction of aneurism into *true* and *spurious* adopted in the schools, is only the production of a false theory; since observation shews, that there is only one form of this disease, or that caused by a *rupture* of the proper coats of the artery, and an effusion of arterial blood into the cellular sheath which surrounds the ruptured artery.

CHAPTER VI.

OF THE ANEURISM OF THE POPLITEAL AND FEMORAL ARTERIES.

§ 1. HAVING completely proved, as it appears [illegible] me, the non-existence of what is called *true* anuerism or aneurism from *dilatation*, in the largest of all the arteries of the human body, the aorta, in which none of those conditions supposed to be requisite for the formation of this disease depending upon excessive distension of the proper coats, the internal and muscular of the artery, seemed to be wanting. No one, I believe, after this, would be easily led to imagine, that the *true* aneurism, or aneurism from *dilatation*, takes place in the arteries of the second order, such as the popliteal, femoral, brachial, carotid, and the like. In these arteries, whether we consider the forces and velocity with which the blood is impelled in them, or the diameter, thinness, and small power of extension of their proper coats compared with the aorta, we must be completely convinced, that the possibility of the formation of *true* aneurism, or aneurism from *dilatation* in the arteries of the second order, is much less than in the aorta. The force of this argument is increased, if we compare the great disproportion between the diameter of any of the arteries of the second order, particularly of the popliteal, with the large aneurism, which is not unfrequently formed in the ham, (the formation of which has likewise been ascribed to a *dilatation*), and the size of the artery from which it is derived. It will appear still more obvious, if we reflect upon the causes which most frequently give rise to this disease, and if, at the same time, we allow the due weight to observations carefully made on the bodies of those who have had the misfortune to be affected with aneurism in one of the arteries of the second order. For, observation and experience have demonstrated, that the popliteal aneurism, in most cases, appears in consequence of violent exertions or strains of the ham, as usually happen in those who carry great weights; and also in coachmen, in postillions, in footmen who stand behind carriages, in fencing masters, in those who daily run messages, or make long journeys on foot, in a word, in all those who are exposed to causes capable of producing a laceration, rather than a dilatation of the artery.

§ 2. I flatter myself, that no one will suppose, that these investigations, with regard to the true nature of *external* aneurisms, can be of little or no use in the cure of this disease. For, although it might unfortunately be too true with regard to *internal* aneurisms, where the hand of the surgeon cannot afford any relief, yet, with regard to *external* aneurisms, it is indisputable, that the accurate knowledge of the nature and proximate cause of this affection, may have, and actually has, as I shall point out, a great influence both upon the choice, and employment, of the most effectual means for retarding the fatal progress of the disease, and also, on the radical cure of it. It may guide us, at the same time, to the solution of that important problem, which is at present the subject of discussion among surgeons;* with regard to the selection of that method of operating, from those of which we are already possessed, the easiest to be performed on the part of the surgeon, and the least painful and dangerous to the patient. If, for example, it is once demonstrated, that the sac of the *internal*, as well as of the *external* aneurisms, is never formed by the dilated proper coats, but by the dilatation of the cellular sheath which surrounds the injured artery, and of the superincumbent aponeurotic, ligamentous fasciæ; is it not a very great error which the operative surgeon commits, to persist in separating the aneurismal sac from the surrounding parts, as if it were an integral part of the artery? and all this from a fallacious and useless hope of being able to tie the artery above and below the root of the aneurism, in a shorter and more secure way, by following the direction of the sac. If it is once proved, that *external* aneurism, far from being formed by a *dilatation*, is always caused by a *laceration* of the artery, occasioned by violent exertions, or by a slow morbid *steatomatous*, *ulcerated*, *squamous* degeneration of its proper coats, would the tying of the artery, in the vicinity of the aneurism, or at a considerable distance from the rupture or ulceration of the artery, be a matter of indifference to the surgeon and to the patient? If both the small and the great extensive *external* aneurisms originate from a rupture, or from a slow ulceration and morbid disorganisation of a certain space of the proper coats of the artery, would the cure which is proper in the first, be likewise suitable in the second case? Would not the ligature be the means to be adhered to in every case, in every circumstance of external aneurism, as the most secure, and from its nature, not dangerous? If in the treatment of incipient *external* aneurisms, the mode of cure by compression has sometimes succeeded, ought we to say that it has happened from the arterial blood in these cases not being extravasated, but remaining inclosed within the proper coats of the dilated artery, and that these coats, by means of the compression, have again contracted, and re-acquired their primary impelling force? Finally, if *external* aneurism, whether it is small or large, be constantly formed by a *laceration* or *ulceration* of the proper coats of the artery, what will then be definitively the cases, in which we may repose confidence in compression as a method of cure, and in what would it be proper immediately, and without hesitation, to have recourse to the ligature of the injured artery?

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* Prix proposés par la société de Medicine de Paris dans sa premiere seance publique, le 27 Prairial, an. v. June 15, 1797.

§ 3. All these important questions relative to the cure of external aneurisms, shall be discussed in the course of this work. In the meantime, in the commencement of this design, it will be proper to proceed to demonstrate, not only in the way of reasoning, but at the same time by observations, facts, and careful dissections of external aneurisms, that, in the arteries of the second order, such as the popliteal and femoral, as well as in the aorta, aneurism, whether it be small, or large and of long standing, is not produced in any other way, than by the laceration or ulceration of the proper coats of each of these arteries, without any previous dilatation of their canal. To attain this end, nothing appears to me more convenient, than to collect for investigation, the principal, and most celebrated cases which we have of this kind, to which I have added some of my own, illustrated with figures drawn exactly from the morbid state of the parts, which I have carefully examined. I shall begin by the relation of the case observed by Dr. Donald

Monro[a] and Mr. Arnaud,[b] as one, which, from a combination of circumstances, all capable of leading to error, appeared to the greater number of physicians and surgeons, as the most proper for confirming the common doctrine with regard to the existence of *true* aneurism, or aneurism from *dilatation* of the proper coats of the artery.

§ 4. John Parker, 48 years of age, after having been affected with lues venerea, and having undergone the operation for strangulated hernia in the left groin, when the wound was nearly healed, perceived a small tumour in the left ham, which the attending surgeon imagined to be a slight swelling of the glands. In January 1760, another tumour of the same kind appeared in the right groin, and about a month afterwards, a third tumour appeared, not unlike the former, about the middle of the right thigh. On the 19th March of the same year, the patient was brought to the hospital. The tumour of the left ham was *circumscribed*, of the size of a large hen's egg, and had a strong pulsation, but did not occasion any pain or swelling of the leg. That in the right ham was large and *diffuse*; had a pulsation, and caused pain and swelling of the corresponding leg. The swelling in the right groin was about the size of a small hen's egg; and that situated in the middle of the thigh, was about the size of a pigeon's; both of these were *pulsating* and *circumscribed*, but gave no pain. A consultation was called, and it was agreed that the case was incurable, and that it ought to be treated only by palliative remedies. About the end of April, the pulsating swelling in the right ham was increased to a prodigious size, and occasioned most excruciating pains; afterwards, the integuments covering it began to inflame, and at last the tumour burst, and gave rise to a fatal hemorrhage. In the body of this patient, the aorta and iliac arteries were in a sound state. On the contrary, the right femoral artery,[c] about a quarter of an inch below the origin of the epigastric artery, was dilated, and the dilatation extended down for 2¼ inches, and had exactly the appearance of an egg. Below this tumour, the right femoral artery continued for about 2¼ inches, as in the sound state, and then began to be again dilated into an oval swelling of near two inches long. The artery re-assumed its natural size for another inch and an half; but afterwards, was dilated as before, into another small sac, which had not been observed during the patient's life. Lastly, the femoral artery having returned to its natural size and form, continued so, as far as the ham, and there opened into the great aneurismal sac, the bursting of which had been the immediate cause of the patient's death. The blood contained in this sac was in contact with the posterior and inferior surface of the os femoris, which it had stripped of its periosteum, and rendered rough and carious. The left femoral artery, a little below the crural arch, formed a swelling about the size of a nut, which had only been observed about two days before the patient's death. No other tumour was found in this femoral artery, except in the ham, where it was dilated into a sac capable of containing six or eight ounces of fluid.

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[a] Essays and Observ. Phys. and Literary of Edinburgh, vol. iii.

[b] Mémoires de Chirurgie, vol. i.

§ 5. Dr. Donald Monro considered these enlargements of the femoral artery, as so many aneurisms from *dilatation*. Indeed, they had all the external appearances of it, and seemed formed for giving credit to the common opinion with regard to the nature of this disease. Mr. Arnaud, however, did not fail to remark, that the coats of which these tumours were formed, far from having become thin, were unusually hard and thickened; which was not very consistent with the idea of their originating from the proper coats of the dilated artery. Dr. Monro, the father, having carefully examined these arteries supposed to be affected with aneurism from *dilatation* in several places, wrote to his son in the following terms.[d] 'The aneurismal sacs you sent to Edinburgh were dissected by 'your brother, in my presence; the appearances were 'the following. The external loose cellular, and the 'cellulo-membranous coats being dissected away carefully, the circular fibrous, commonly called muscular, coat, was evidently seen continued on all the 'three small sacs in every part of them, but was 'thicker there than in the sound part of the artery.' And, *what is worthy of the greatest attention*, 'in 'the most enlarged part of the sacs, an extraneous 'substance, resembling a soft steatomatous matter, was 'intermixed with the muscular fibres. The cellular 'substance lining the inside of the muscular coat, 'was considerably thicker than natural, and had much 'the same appearance of an extraneous substance filling its cells. The internal membrane of the artery 'adhered so firmly to these cells, that it could not be 'separated, but seemed thicker than in a sound state.[e] 'Though the circular fibres could be observed at the 'sides of the incision made into the fore part of the 'sac of the left ham, as represented in your figure;

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[c] Essays and Observ. Phys. and Lit. of Edinburgh, vol. [illegible] plate 1.

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[d] Loc. cit. pl. 1, fig. 9, 10.

[e] Loc. cit. pl. 1, fig. 10.

'yet, as the dissection was continued backwards towards the most distended part, these muscular fibres became less observable, and could not be traced. Whether this apparent defect of them here was owing to a much greater proportion of the extraneous substance above mentioned, or to their having been destroyed by the great distension, is difficult to determine. The internal cellular coat of this sac was considerably thicker than in the smaller ones, but of the same texture. The most internal membrane was in a thickened adhering state. In the part of the great sac of the right ham which came to Edinburgh, no circular fibres could be seen, and the structure was otherwise much the same as that now described of the back part of the sac in the left ham.'[f]

§ 6. It clearly results from these accurate dissections and observations of Dr. Monro, the father, that the tumours supposed by Dr. Donald to be so many aneurisms from *dilatation* of the popliteal and femoral arteries, were, properly speaking, only steatomatous thickenings of the proper coats of the two arteries, and that these thickenings of the proper coats of the artery, instead of forming sacs, or receptacles for the arterial blood, rather diminished the natural diameter of the artery. In the left ham, from the artery on the posterior secting an aneurism apparently *true*, or from *dilatation* of the popliteal artery, which was about the size of a small hen's egg. This aneurism occurred in the body of a pale, emaciated, middle aged countryman, who had been affected with a pulsating tumour for four years, without having felt any considerable pain from it, and without its having induced any swelling of the leg. The death of this man was occasioned by a chronic tubercular affection of the lungs, complicated with hydrothorax. The left popliteal artery, low down between the heads of the gastrocnemius muscle, was elevated into a blackish tumour, and, as it were, covered by *ecchymosis*. To the touch it was rather of a firm consistence, and in some points even hard. On removing carefully the cellular sheath which covered the tumour and the artery, and along with it the greatest part of what formed the *ecchymosis*, the circular fibres appeared upon the tumour, precisely as in the figures of Monro and Guattani, continued from those which formed the muscular coat of the popliteal artery, above and below the tumour. These fibres upon the tumour were thicker and more rigid than those which surrounded the tube of the sound artery. On introducing a probe by the upper part of the popliteal artery, it met with obstructions on passing through the tumour. Having divided the tumour in the direction of the artery, I found that it was formed by the proper coats of the popliteal artery, particularly the internal coat, unusually thickened, brittle, intermixed with a matter partly caseous, partly earthy, and having exactly the appearance of a piece of sponge dipped in wax. The internal coat was rough for a considerable way, both above and below the tumour; and that coat, along with the muscular coat, contributed by their unnatural thickness to narrow greatly the tube of the artery; or in other words, produced an effect quite the contrary of what ought to have taken place, if the tumour had been formed by a *dilatation* of the coats of the popliteal artery. The ecchymosis covering the tumour shewed that the blood had begun to ooze through the connexions of the fibres of the muscular coat. It is probable, if this patient had lived a little longer, that he would have met with the fate of John Parker, in whom the *steatomatous* tumour of the right popliteal artery had changed into an aneurism, from the rupture of the thickened coats of the artery.[1]

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[f] This kind of degeneration of the coats of the artery into steatomatous tumours, had been observed before in the aorta, by Stentzel. (See above, chap. v, § 20.) And I am of opinion, that those thickenings of the subclavian and ulnar arteries, described and delineated by Kaltschmied, were of the same nature, which he considered to be true incipient aneurisms. Programma de variis præternaturalibus in sectione cadaveris inventis. See Haller. Disput. ad morb. histor. t. ii.

§ 10. I have shewn, in the preceding chapter, that the *steatomatous* degeneration of the proper coats of the artery is not the only morbid state which disposes it to burst in some point of its circumference. I have pointed out other affections to which the membranes of the arteries are subject, equally capable of occasioning this fatal accident, such as the squamous induration with rigidity, the ulceration, the excessive relaxation and softness of the arterial coats, especially in those places in which the arteries are more particularly exposed to the action of external agents. Each of these morbid states of the arterial coats, and in particular of the internal, produces aneurism in the arteries of the second order, as in the aorta, by occasioning a rupture or laceration of the internal coat, and allowing the blood to ooze out, or to be effused into the cellular membrane surrounding the affected artery. It has been remarked above, that in the cases of *steatomatous* degeneration of the proper coats of the artery, with great thickening of these coats, although there were several pulsating tumours in the same patient, no proper aneurism was formed in any part of the whole arterial system, except where, besides the *steatomatous* swelling, there also existed a rupture of the internal coat, or of it, along with the muscular; and that consequently an effusion of blood into the cellular membrane, surrounding the artery in the manner of a sheath, had also taken place. The following observations will confirm still more the truth of this fact.

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[1] Salii diversi tractatus de feb. pest. cap. xxi. De affect. particul. It seems that this author was acquainted with the steatomatous affection to which the arteries are subject. For, he says, obstruuntur arteriæ a duplici causa, nam vel ex succis frigidis, vel ex crudo tuberculo in iisdem genito, obstructione laborant. Ubi enim humores crassi, et viscosi in ipsis arteriis infarcti fuerint, vel ubi phyma aliquod seu tuberculum crudum in iisdem genitum erit, arteriæ obstruuntur.

§ 11. Guattani, in his first case, has given us the account of an aneurism, which extended from the middle of the thigh to the calf of the leg. On opening the tumour, and evacuating the grumous blood, he did not find that the artery had been converted into a sac, but that it was lacerated for a long space; so that, as he observes, it was impossible to discover the sound portion of the tube of the artery, until he had made an opening with his fingers and the knife above the tumour.[m] In the second case he relates the history of a man of about 25 years of age, of a slender make, obliged by his trade to raise very heavy weights, in whom an aneurism suddenly appeared in the ham, which in a short time increased to eight fingers-breadth in circumference. Considering, in this case, the occasional causes which are capable of producing violent strains of the ham, and observing the rapid increase of the tumour, no person, I suppose, will imagine, that this aneurism was formed suddenly by the distension or dilatation of the proper coats of the popliteal artery, but that it undoubtedly arose from a rupture of these coats.

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[m] Loc. cit. Arteriæ lacerationem tantam offendi, ut superiorem integrum ejus truncum vinculo adstringere non antea potuerim, quia mihi per ipsum femur digitis ferroque iter aperuissem.

The fact, which the author relates in his fourth case, is particularly worthy of attention. An aneurism, supposed to be an abscess, was opened in a coachman. The immoderate hemorrhage was repressed by strong compression; the wound of the ham suppurated, and the patient was cured. Five years afterwards he died of a quite different disease. On examining the ham, the popliteal artery was found converted into a continued solid cord, without there being the least appearance of any portion of the artery having been changed into an aneurismal sac.

In the sixth case, Guattani speaks of a popliteal aneurism, he supposed to be a *true* one, which occurred in a man whilst in the act of raising a weight; under this exertion the patient evidently felt something burst in his ham. Two months after the accident, the tumour had acquired the size of a goose's egg.

In the tailor, who forms the subject of the twelfth case, the popliteal aneurism burst, and the patient thereby lost his life. In the dead body there was no appearance of dilatation of the proper coats of the popliteal artery, but merely a laceration of about three inches in length.

The fifteenth case contains the history of an aneurism of the femoral artery, in the vicinity of the crural arch, which was cured by an incision and compression. With regard to which case Guattani allowed, that the immediate cause of it had been the laceration, and not the dilatation of the artery.

The same circumstance was likewise very evident in the subject of the seventeenth case, in which the aneurism extended above and below the crural arch; for, on opening the tumour, and evacuating the clots of blood, the *external* iliac artery was found torn for more than four fingers-breadth in extent, without the proper coats of the artery having, by their dilatation, contributed in the least to the formation of the aneurismal sac.

In the body of a young man about 28 years old,[a] who had had an aneurism in each groin of the size of an apple, Guattani found that the aneurism of the left groin had been formed by a laceration of the femoral artery; but with regard to that of the right groin, it would seem that the author did not observe that it was not an aneurism, but a *steatomatous* tumour of the proper coats of the artery, which clearly appears from the description and figure which the author has given of it.[b]

In the twentieth case, Guattani relates the history of a young man, 30 years of age, who had a true aneurism at the top of the calf of the leg. On dissecting the ham, the popliteal artery was found not to be at all dilated, but *lacerated.*

Lastly, Guattani records the case of a young man of about 30 years of age, of a soft fibre, having been affected in his early youth with lues venerea, who, in the act of lifting a great weight, slipped with his right foot, and then trying to support himself on his left, felt a severe pain in the thigh of that side, which forced him to allow himself to fall down. The pains ceased by the employment of proper remedies; they afterwards recurred as violent as before, and at the same time a tumour was observed about the middle of the thigh, which had all the characters of an aneurism. The pains and the swelling increased successively, and the patient felt suddenly, in the deep part of the tumour, a crepitation just as when one tears a piece of linen. Five hours after, the patient experienced the same disagreeable feeling, and after other four hours, a similar sensation, though less violent than the former; after this, the tumour increased greatly, and shortly thereafter, the patient having fallen intó a state of extreme languor, was attacked with a convulsion, during which he expired. On opening the tumour, it was found to contain about three pounds and an half of blood, partly coagulated, partly fluid. In the bottom of the sac, the femoral artery was perceived not *dilated*, but *lacerated* for about two finger's-breadth in length. Below the place of the laceration there was a tumour nearly of the size of an egg. On opening this tumour, it was observed, that the canal of the artery, where it passed through the centre of it, was unusually contracted, and the tumour was formed by a morbid thickening of the proper coats of the artery, the internal of which was ulcerated in two places.[1] This pathological state of the artery, as represented by Guattani and Monro, deserves to be considered with the greatest attention by surgeons, both because it opens the way to many useful reflections on the diseases of the arteries in general, and in particular on the nature and character of aneurism, and as it conduces likewise, as will be seen in the sequel, to establish advantageous precepts with regard to the radical cure of this disease.

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[a] Histor. xviii.

[b] Tab. xi, fig. iii, of Guattani oper. citat.

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[1] Loc. cit. Singulare femoris aneurysm. Hist. v, fig. 4.

§ 12. The result therefore of the examination of all the cases of aneurism of the popliteal and femoral arteries related by Guattani is, that none of the cases which he observed and described, furnishes an example of a *true* aneurism; that they even prove the contrary, and shew that the external aneurisms, of which he has given an account, had all been produced in consequence of either a *rupture* of these arteries, occasioned by violent exertion, or of a *steatomatous* degeneration of their proper coats, or of an *ulceration* and corrosion of these coats.

§ 13. A similar conclusion may also be drawn from the observations of Flajani.[q] 'Fulgenzio Aquilano,' (says he, in his third case), 'about 32 years of age, 'of a cachectic temperament, much addicted to hunt'ing, about the beginning of July 1781, stumbled in 'walking through a thick wood. He made a great ex'ertion to save himself; but notwithstanding, he had 'a violent fall. In falling, he felt a crack in his ham, 'as if the os femoris had been fractured. On rising 'from the ground, he could with difficulty proceed as 'far as his own house. The pain obliged him to keep 'his bed for several days. It abated by rest, and the 'patient was again able to walk about. Towards 'evening, however, he observed that the affected 'knee was larger than the sound one. He perceived 'afterwards, that there was a swelling in the ham, 'which had a strong pulsation. Amputation was per-

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[q] Nuovo metodo di medicare alcune malattie spettanti alla chirurgia.

'formed, and on the examination of the amputated 'part it was found, that the popliteal artery *was nearly* '*of its natural diameter*, and that three fingers-dis'tant from its division into the posterior tibial artery, '*there was a hole*, from which the aneurismal sac had 'been formed.'

The same author (Osserv. V.) relates the case of James Sartori, about 50 years of age, of a bilious parched temperament, and much addicted to drinking and hunting, who, in returning from the country, was suddenly attacked with a violent pain in the back part of the knee, attended with a crepitation not unlike that which is felt on tearing a piece of cloth. He was obliged to throw himself on the ground, and in a little while he rose up and went home, which he with difficulty effected, and was forced immediately to go to bed. The pain was moderate during the night, therefore he rose early, but was obliged very soon to return to bed, as he felt the same painful sensation as on the preceding day. After six days of rest, he was able to walk and stand on his feet without great inconvenience; but it is worthy of remark, that towards evening the pain always increased, and the leg swelled so much as to confine him to bed. Six months having elapsed, he was visited by a practitioner, who advised him to keep himself very quiet, to lose a little blood every two months, and to compress the tumour with a leaden plate. These prescriptions having proved unsuccessful, the patient resolved to come to the hospital. I found (continues Flajani) the leg and foot much swelled, and at the upper part of the ham, almost as high as a third of the thigh, a tumour was observed of the size of a large pear, and externally of a livid colour. I compressed it with the palm of my hand, and perceived a deep pulsation in it. The patient could not bear the compression, and it was found, that, in addition to the tumour, which was much increased in size, there was conjoined a swelling, extending from the groin over the whole limb. The pulse was very low; black spots were observed, and the foot was perfectly cold. Three days afterwards the patient died. In the dissection of the body (adds this author) I found almost the whole crural artery aneurismatic, beginning four fingers below Poupart's ligament. In proceeding towards the ham, it increased in bulk, and its component coats were rendered so compact, that they approached to a bony nature. The aneurismal sac *formed by the popliteal artery* was found open, and at its under part, near its division, the artery was quite impervious.

§ 14. Of these two cases related by Flajani, the first was, without doubt, an aneurism from a rupture of the popliteal artery. The second, in my opinion, was likewise so. For, the long space of the femoral artery, which the author found enlarged in diameter according to the longitudinal axis of the artery, did not constitute an aneurism; and the aneurismal sac in the ham could not have been formed by the membranes of the popliteal artery, since its proper coats, as the author expresses it, were become so compact, that they approached to the nature of bone. Farther, the aneurismal sac at its lower part was quite impervious, which could not have been the case if it had been formed by the proper coats of the artery.

§ 15. Warner[1] mentions that he opened an aneurism of the popliteal artery, supposing it to be a tumour of a different nature. He proceeded instantly to the amputation of the limb, and saved the patient.

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[1] Philosoph. Transact. an. 1757, pag. 363.

On examining the amputated part, he found the femoral artery in the vicinity of its division into anterior and posterior tibial, not *dilated*, but *lacerated* longitudinally, and *indurated* for more than four inches.

§ 16. Several years ago I examined carefully, in a butcher, a very large popliteal aneurism, with which he had been affected for a long time. The tumour had increased to a very great size, and threatened to burst, on which account I was obliged to amputate the thigh. The preparation is preserved in the pathological cabinet of this university. On dividing longitudinally the artery on one side, and the aneurism on the other, and cleaning it thoroughly from the clots of blood, I saw distinctly at the bottom of the sac the popliteal artery, which, near the place where the femoral artery perforates the long portion of the adductor magnus muscle, was lacerated for the space of an inch and an half. Above and below the laceration the canal of the popliteal artery was sound, and of its natural size, except that, when stripped between the fingers, the coats of it appeared to me less firm than usual. Observing attentively the fissure, as it appeared in the bottom of the sac, I discovered distinctly the limits of the ruptured artery, and the beginning of the cellular aneurismal sac. For, as the popliteal artery was lacerated on one side, the inside of the tube could be distinguished beyond the edges of the rupture, situated more deeply; and it appeared in the form of a furrow, the edges of which marked the limits between the arterial tube and the beginning of the sac of the aneurism.

§ 17. Such was nearly the form of the lacerated artery in the popliteal aneurism presented by M. Hernu[*] to the Society of Medicine of Paris, as an example and undeniable proof of the existence of the popliteal aneurism from dilatation of the proper coats of the artery. Whoever will bestow a little attention upon the figure of this aneurism which Hernu has given, will see pointed out, at the bottom of the sac, that furrow above described, which is nothing but the uninjured side of the artery opposite to the place of the rupture. And, in the same figure, the limits of the rupture of the proper coats of the artery may be distinguished from the beginning of the cellular aneurismal sac, which is likewise distinguished internally from the tube of the artery at its beginning by the remains of a strip of the torn arterial coats. However, this furrow, formed by the side of the artery opposite to that where the rupture has happened, is not observed equally clear and distinct in every individual case of aneurism of the femoral and popliteal arteries; for sometimes the artery bursts completely, or nearly in the whole circumference of its tube, and then very little or none of the uninjured side of the artery remains in continuity with the inferior portion of the artery. In these circumstances, the two apertures o the ruptured artery are more distant from each othe than in the first case; and on detaching the two e tremities of the ruptured artery from the cellul membrane, and from the aneurismal sac, which s rounds and conceals them, it will be found that t two portions of the divided artery are not at all creased beyond their natural diameter, and that t muscular coat, instead of being expanded over aneurismal sac, never leaves the canal of the artery, but evidently terminates at the circular edge of the rupture.

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[*] Recûeil Periodique de la Societé de Med. de Paris, to fig. 1, A. See also Guattani, tab. ii, fig. 2, o o. Watso dical Communications, t. i, plate vi, C.

§ 18. Palletta was obliged to amputate the left thigh of a middle aged man on account of an aneurism. I had an opportunity of examining carefully the amputated part. The popliteal artery had burst very high in the ham, or about two inches below its passage through the long portion of the adductor *magnus*, and the continuation of the artery was observed at the under part of the ham, covered by the muscles of the calf of the leg. The superior portion of the popliteal artery was not at all dilated beyond its natural diameter. Around the place of the rupture the torn edges of the artery could be distinguished from the neighbouring parts, and the limits of the proper coats of the artery, and the beginning of the cellular aneurismal sac, could be clearly perceived. On separating carefully the cellular membrane surrounding the popliteal artery, I found, as is seen in aneurisms of the aorta, that the fibres of the muscular coat stopped short at the edges of the rupture of the artery, and were not at all continued upon the aneurismal sac, and that therefore the sac did not belong in the smallest degree to the coats of the artery. The cellular aneurismal sac, covered by the ligamentous and aponeurotic fasciæ, was inclined towards the external condyle of the femur. In the beginning of the dissection, when the integuments of the ham and the expansion of the *fascia-lata* were scarcely removed, there appeared, on the greatest convexity of the tumour, the great popliteal and the cutaneous nerves so much distended by the subjacent tumour, that they resembled more two large fasciæ than nervous trunks.

§ 19. The following case will support what has been deduced from the preceding. A man about 37 years of age, of a robust constitution, by trade a gardener, in the year 1799 received a very violent blow of a sabre on the left parietal bone, and on the same side of the face; in consequence of this accident, even after the wound was cured, he remained almost paralytic of the whole left side. In the course of time, and by the use of proper remedies, he recovered in a great measure the power of moving the left arm, but not so well that of the left lower extremity. In the winter 1808 he ascended mount Varallo, which he performed with great difficulty and labour, on account of the deep snow and ice over which he was obliged to pass. After returning home, he resumed his occupation of a gardener. Not long afterwards, however, he was attacked by a deep seated pain in the whole left knee, with difficulty of moving it. In the month of May of the same year, he observed that a small pulsating tumour was forming in the lower third of the left thigh, or nearly at the place where the *superficial* femoral artery perforates the tendon of the adductor *magnus* muscle. The patient afterwards perceiving that the swelling went on continually increasing, came to the hospital of Pavia the 24th July of the same year. The tumour at this period was about six inches in longitudinal diameter, and extended a little also towards the posterior part of the thigh, and to the top of the ham. The leg of that side was the same as the sound one. On the 3d August Dr. Volpi performed the Hunterian operation on this patient, which he executed with the greatest possible precision. Every thing went on well till the 9th day, when the patient was attacked by a severe pain in the false ribs of the left side, with great difficulty of breathing and cough; then by typhus fever, with puriform expectoration, and colliquative diarrhœa. In this state, in spite of the best assistance of art, on the 16th day after the operation the wound became livid and sanious. On the 18th the ligature of the artery was near coming away, and the bulk of the aneurism was very much diminished. Notwithstanding this, the patient sunk under the violence of the pulmonic affection. On dissection, the left lobe of the lungs was found putrified and melted down, and the left cavity of the breast full of puriform matter.

We then proceeded to the examination of the inferior aneurismatic extremity.[t] Having laid bare the aneurismal sac, and along with it the *superficial* femoral artery, as far as the cavity of the ham, it was found, that, instead of one, there were two aneurisms; the first, and the largest,[u] situated above the passage of the femoral artery to the ham; the other, smaller,[v] situated at the top of the ham. The small space of about an inch and an half of sound artery[x] between the two aneurisms disappeared when the leg was half-bent, and made it appear as if there hadbeen only one tumour instead of two. The femoral artery, both above and below, and between the two aneurisms, had preserved its natural diameter.[y] On opening the two aneurisms, the orifices of the femoral and popliteal arteries appeared in each of them; and they were not only burst laterally for a small space, but ruptured in their whole circumference.[z] But, as the aneurismal sac surrounded and included within it a certain

[t] Pl. ii, fig. 1.
[u] ——— *a.*
[v] ——— *b.*
[x] ——— *d.*
[y] ——— *c d e.*
[z] ——— *g g g g.*

space of ruptured artery, I employed every possible care to follow the artery within the substance of the sac, to discover if the muscular coat of the artery advanced over the beginning at least of the aneurismal sac. I found that the external cellular covering of the artery[a] separated from it to form part of the sac, but that the muscular coat of the artery[b] never left the tube of the vessel, and its fibres were seen terminating at the edge of the circular rupture. It therefore clearly appeared, that it was not a dilatation, but a double rupture of the artery, which had given rise to these two aneurisms. Whoever will compare this figure with plate 1, will see clearly that the formation of this disease is absolutely the same, both in the trunk of the aorta, and in the arteries of the second order.

§ 20. Morgagni[c] relates, that a man of about 40 years of age died of an aneurism of very considerable size in the vicinity of the right groin. In the dissection of the body, performed by Valsalva, it was found that the femoral artery, moderately enlarged in size, was in several points *corroded* and *lacerated.* In like manner, he mentions, that in the body of a man who had a popliteal aneurism, the femoral artery was found a little larger than usual, where it passes through the tendon of the adductor *magnus*, but that a little below, the artery was *lacerated* and *wanting.*[d]

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[a] ——— *ffff.*

[b] ——— *gggg.*

[c] De sed. et caus. morb. epist. 50, art. ii. 55. Viro quadraginta annos nato parvus, sed pulsans tumor circa inguen dexterum sensim aboritur. Triennii spatio in dies augetur, grandisque fit. Quarto circiter ante obitum mense doloribus vexare incipit, magnoque,' et æquali œdemate universum illum artum inferiorem tumefacere. Mense ultimo atrocissimi dolores fiunt, neque ad tumorem solum, sed et aliquando infra maleolum internum : quo uno loco, et sævientibus duntaxat doloribus, pes sentiebat, omni alioquin sentiendi, et movendi facultate privatus. Nulla unquam toto hoc mense a cruciatibus quies, nullus somnus, donec languentibus viribus, aliquot dies semisopitus æger jacuit, atque ita defecit. Aneurysmatis hujus ingens erat cavum ; nam a cute summi femoris anteriore ad crassissimum nervorum omnium cruralem posticum perve-

§ 21. Mr. Home, in the account which he gives of Mr. Hunter's method of curing the popliteal aneurism, relates the following case. John Lewis, a negro about 43 years of age, received a blow on the anterior part of the right thigh. A month afterwards, he perceived that a small tumour had formed at that place. The tumour increased to such a degree as

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iebat. Et arteria quidem cruralis, ex cujus dilatatione tumor incipiebat, mediocriter dilatata reperta est; sed aliquot locis dilacerata, aut erosa, per hæc ea copia, eoque impetu sanguinem ejecerat, ut partim corrosis, partim cedentibus musculis, ingens, ut diximus, cavum effecisset, illumque ipsum, quem memoravimus nervum sic erosisset, vix ut paucæ fibræ superessent per quas superior ejus pars cum inferiore committeretur.

[d] Loc. cit. Cruralis arteria jam inde ubi a latere femoris anteriore ad posteriora deflectit, statim dilatari incipiebat. Deinde ad tractum dimidiæ circiter ulnæ frustra arteriæ truncum quæsivisses; in surâ demum rami in quos se dividit apparebant. Toto illo autem tractu nihil nisi ingens cavum sanguine fœdum, erosis videlicet omnibus, atque adeo prorsus absumptis nervo, et vena, quæ inter imos a tergo provenientes ossis femoris processus, arteriæ comites se addunt; vix hujus tunicarum reliquiæ aliquæ supererant ossibus adhærentes. Ossa autem ipsa quoque erant ex parte erosa, nempe illorum, quos modo dixi processuum posterior facies, et summæ fibulæ. Morgagni in this, as in many other places where he mentions the dilatation of arteries, means an enlargement according to their longitudinal diameter, which, as I have mentioned in several places, has nothing in common with aneurism, and may exist without it; and therefore, if this enlargement of the artery, according to its longitudinal diameter, is sometimes met with, it never constitutes the aneurismal sac, and consequently has nothing to do with the aneurism.

to occupy two thirds of the thigh, and was accompanied by a strong pulsation. This tumour was considered to be a case of *true* aneurism, or from dilatation of the proper coats of the artery. The dissection of the body shewed that the femoral artery was not at all dilated, but *ruptured.*

§ 22. A man about 48 years of age,[e] in entering suddenly a dark room, struck his left groin violently against the corner of a table. About ten days after, he perceived a swelling in the place, about the size of a pigeon's egg, which was thought to be an indurated glandular swelling. The patient, however, finding that it increased daily, consulted Mr. Clarke, surgeon, who was immediately satisfied that the disease was a femoral aneurism. Three months after, the tumour had acquired the size of a melon, and the throbbing pulsation was so strong as to raise the bed-clothes. The aneurism degenerated into gangrene, burst, and allowed the escape of a great quantity of grumous putrid blood, without, however, any hemorrhage taking place. The surgeon being surprised at so unexpected an occurrence, introduced his finger into the bottom of the aneurismal sac, and could feel no longer a pulsation in the femoral artery. He supported the strength of the patient, and succeeded in obtaining the separation of the gangrene. Unfortunately the patient was soon after attacked by a severe acute affection of the breast, which hurried him to his grave. The dissection of the body shewed that the femoral artery was not at all dilated, but *lacerated*, and that the artery had closed spontaneously, or by the usual effect of gangrene, for a certain space above and below the laceration.

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[e] Duncan Med. Comment. Decade ii, vol. iii.

§ 23. John Robertson, by trade a carpenter,[f] in full health, the 23^{d} of December, being in liquor, fell several times in the streets. On the 26th he perceived a small swelling in the middle of his left thigh, accompanied with pain and strong pulsation. By the 3^{d} of January, the swelling having acquired a considerable size, the patient was brought to the hospital. Next day a consultation was held, and all the surgeons were of opinion, that the tumour was an aneurism from *effusion*, occasioned by the *rupture* of some large artery of the thigh. It was determined that the tumour ought to be opened, and if the ruptured vessel was found to be only a branch of the crural artery, that it ought to be tied; but if it was the trunk of the crural artery which was ruptured, that amputation ought immediately to be had recourse to. The tumour was opened, and as it was the trunk of the femoral artery which was ruptured, the amputation was immediately performed.

§ 24. The following case forms an interesting contrast with the preceding with regard to the method of cure employed by the celebrated surgeon Desault.[g] Charles Lorenzo Miglio, a goldsmith, 37 years of age, of a bilious constitution, in the 20th year of his age had a gonorrhæa, accompanied with bubo. The gonorrhæa continued for a long time; the bubo suppurated, and healed in the course of two months, without it having been necessary to employ internally any mercurial preparation. From that period to his 36th year, this man enjoyed good health. Afterwards he had the itch, which was cured by the use of sulphur

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[f] Essays and Observ. Phys. and Liter. of Edinburgh, vol. iii. Case vii. of Monro.

[g] Journal de Med. de Paris, i. 87.

‘ I therefore applied my hand to both tumours, to
‘ ascertain the truth of my conjecture; but I could no
‘ perceive either pulsation, or that dull sound, which,
‘ it is pretended, is met with in the *false* aneurism.
‘ Under these circumstances, I did not choose to proceed
‘ farther with the knife, I therefore bound up
‘ the wound in the œdematous leg. The day after,
‘ about three ounces of blood were discharged from
‘ the incision. The patient was tormented with most
‘ acute pain of the thigh, and a sense of great tension,
‘ although no greater swelling was perceived than
‘ usual. As a farther aggravation of his suffering,
‘ the patient was affected with anxiety, general paleness,
‘ a very small pulse, and syncope, which carried
‘ him off the third day after he was taken ill.
‘ This disease, of which it was impossible to trace any
‘ predisposing cause, increased, from a small nut,
‘ gradually to the size of the fist, and the increase was
‘ perhaps more rapid after the application of emollient
‘ poultices, with the intention of bringing the tumour
‘ to suppuration. On making an incision lengthwise
‘ in the thigh, and laying bare the crural artery, it was
‘ found to be sound in its whole course, till the place
‘ where it passes under the os femoris, where it was
‘ open for about the space of an inch on its anterior
‘ surface, or precisely opposite to the posterior surface
‘ of the bone, two finger's-breadth above the
‘ joint of the knee. The extravasated blood was partly
‘ collected under the sartorius muscle, between the
‘ end of the triceps, vastus internus, and rectus
‘ muscles, thus forming suddenly a more conspicuous
‘ tumour. This blood consisted of blackish clots.
‘ Another portion of it had made a way between the
‘ triceps, gracilis, and biceps muscles, along the internal
‘ part as far as the middle of the thigh, and seem-

'ed to consist of purulent serum, containing small 'clots of blood swimming in it. Lastly, the fibrous 'part had become dense, and was collected in greater 'quantity towards the ham, and under the skin covering the superior portion of the gastrocnemii muscles. 'The artery was not observed to be dilated at any 'point beyond the aperture, although it was insulated 'on every side, and, to use the expression, suspended in the cellular membrane.'

'A man of short stature, with a curvature of the 'lower extremities from rickets, with which he had 'been affected in his youth, in the 30th year of his age, 'was exposed to the infection of gonorrhœa with bubo. 'Six years after this misfortune, in the winter of 1781, 'he was attacked by rheumatic pains of the thighs and 'legs, of which it was impossible to learn the progress 'or termination, as the patient was unable to state the 'phenomena that had occurred during his indisposition. From about this time, however, the commencement of the aneurism of the right ham may 'probably be dated, as it was of the size of a turkey's 'egg, and not very hard, with an evident pulsation. 'As there was some swelling of the calf of the leg, 'it was thought that the bandage recommended 'by Genga, moistened with the vulnerary water of 'Theden, might be employed with permanent advantage. But neither the bandage, nor the compresses 'of gall-nuts softened in red wine, produced the least 'favourable change in two months; and the pains in 'the aneurism, with the swelling of the leg, were rather increased, on which account I thought it would 'be better to suspend every kind of application, and 'then proceed to the operation pointed out by Mr. 'Hunter. But the aneurismal tumour augmented rapidly; the skin inflamed, and to crown all, a fever supervened, with shooting pains in the tumour, especially during the night, great restlessness and emaciation, so that there was no longer room to think of an operation. The knee soon after began to swell, and two blackish spots appeared in the ham, from which there oozed a bloody sanies, in such quantity as to moisten the bed-clothes. The œdema occupied the leg, which had become heavy and torpid, with a stinging sensation in it. In a short time the leg lost all sensation, and became very cold; a large gangrenous eschar covered the aneurism; the pulsation disappeared, the skin of the leg became livid, and the pains and fever went off. At last the eschar burst, and there issued out a few clots of blood; then a great quantity of fluid blood; the pulse was not to be felt; the patient implored relief from the oppression which overwhelmed him, and suddenly died. The crural artery was laid bare from its origin, as far as the aneurism, an incision was made into it, and in its whole course there was not observed either *ossification*, inflammation, rigidity of the coats, or obstruction of its canal. The opening of the artery was oblique, or cut like a writing pen, with the edges glued to the neighbouring cellular membrane, with which they formed one substance. The rupture, which was about an inch in extent, was situated above the division of the artery into the branches of the leg. The *anterior* tibial artery remained pervious to a probe, and was nearly in its natural state; the *posterior* was obstructed by a sort of spongy substance, which hindered the passage of a probe. The sac was found full of clots and concretions of coagulable lymph. The periosteum and the ligaments of the joint, had contracted a leaden colour; and a yellowish colour, accompanied with a little indura-

'tion was communicated to the adjacent cellular sub'stance, to the fat, and also to the bundle of popli'teal nerves. In short, it was obvious, that the arte'rial cylinder had not suffered *any dilatation* from 'its commencement, to the rupture situated in the 'cavity between the two condyles of the femur.'

'A married man, about 42 years of age, a silk-spin'ner, of a stout constitution, and who had always been 'healthy, if we except a fever of the acute kind, with 'which he had been affected in his twenty-fifth year, 'and the cause of which was ascribed to a violent 'fright, having been in danger of his life. In carrying 'a great weight, he felt as if a fibre had broken in the 'thigh, but was unable to assign the period when it 'happened. But about a year after, he began to suf'fer violent shooting pains in the left ham, which he 'supposed to be rheumatic, without any local swell'ing or inflammation. To allay these pains, he ap'plied flour and warm resolving herbs, with very lit'tle relief; and in a short time, a small circumscribed 'throbbing tumour, as large as a nut, was discovered 'at the pained part. It increased to the size of the 'fist in six weeks, and he applied at the hospital about 'the 5th June 1792. In addition to the pulsating 'aneurism, and a swelling of the left leg, the patient 'had a certain frequency and vibration of the arteries, 'and an extraordinary pulsation of the heart, which 'did not leave any room to doubt of the existence of 'an internal aneurism. Having tried without benefit, 'cold local baths, and a compressing bandage, the leg 'and foot were attacked with gangrene. After it had 'stopped short in the lower third of the leg, amputa'tion was performed. On examining the amputated 'part, the aneurismal sac was found full of very hard 'clotted blood, which stopped up the inferior passage

‘ of the popliteal artery, and had so impeded the circulation of the blood, as to cause the supervention of gangrene. On the anterior part of the sac, at a point where it was open, the internal condyle of the femur was carious. The gangrene, which externally had confined itself to the integuments of the lower third of the leg, proceeded upwards internally along the cellular membrane, as far as the middle of the leg. The left cavity of the chest contained a little water; the heart was flaccid and sound. The aorta was likewise sound, except that its arch appeared to me to be a little more enlarged than natural. All the other vessels had their natural diameter. The extremity of the divided artery next to the thigh, was blocked up by a white coagulum, on removing which, although sixteen days were elapsed, the canal was still found open to its extremity.’

§ 27. It appears to me unnecessary to relate a greater number of facts than have been already stated, in order to prove the non-existence of the *true* aneurism, or aneurism from dilatation of the proper coats of the popliteal or femoral arteries; and the more so, as several other cases, which I could adduce, are perfectly similar to the preceding, both with regard to the occasional and proximate causes which have produced them, and as to the results of the careful injections in the bodies of those who have suffered from this formidable disease. The proximate cause of the popliteal or femoral aneurism, has been found invariably to proceed from the *rupture*, and never from the *dilatation* of the proper coats of the artery in the manner of a sac. The disposition to this affection might, in some patients, be referred to a *steatomatous*, *earthy*, *ulcerated* degeneration of the internal coat of the artery; in others, to a *rheumatic* virus; in others, to the *venereal* poison which had exercised its influence on some point or portion of the whole arterial tube. And although a violent exertion of some of the inferior extremities had very often given rise to the disease, it is nevertheless very probable, that in those patients who were attacked by this disease, it ought to be ascribed in part to the violence of the force, in part to the unnatural relaxation, and excessive brittleness of the proper coats of the artery, especially at the place where the rupture and aneurism had occurred; since the same violent exertions do not produce a popliteal or femoral aneurism in every person, when there is not at the same time a local disposition to rupture.

§ 28. M. Deschamps[k] in all the histories of popliteal aneurism which he relates, mentions the bursting of an artery. To reconcile the facts to the common doctrine of *true* aneurism, he says, that the popliteal aneurism ceases to be *true* from the time the tumour has acquired a certain degree of size; for, in this case, the proper coats of the artery become thin, and burst, and the edges of the rupture remain firmly attached to the neighbouring cellular membrane, which being compressed by the blood, and by external agents, becomes thickened, and then forms the greater part of the aneurismal tumour.[l] But the first part of this reasoning is merely a gratuitous assertion, and even contrary to the most certain and established facts which we have on this subject; since it is demonstrated, that in the popliteal and femoral aneurisms, the tube of the artery is never dilated at a given point, in the manner of a sac, and that, if sometimes the popliteal or femoral artery is found to be somewhat greater than usual in diameter above the seat of the aneurism, this enlargement, in the first place, does not happen in every case, or it may be naturally so; and if even it should happen to be larger than natural, it would neither constitute the proximate cause of the aneurism, nor form the aneurismal sac. In the second place, if what M. Deschamps asserts were founded on fact, the sac in the incipient small popliteal or femoral aneurisms, ought always to be found covered by the muscular coat of the artery, and in the large aneurisms of this order, a portion at least of the sac, in the vicinity of the injured artery, ought to be evidently formed by the proper coats of the dilated artery; since it is not to be presumed, that after the rupture of the aneurismal sac, which was before formed by the artery alone, the muscular coat should retract so far, as to be reapplied to the tube of the injured artery, and disappear. But from what has been said above, it appears, that instead of this, quite the contrary is met with in the careful examination of the aneurisms of these arteries.

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[k] Observ. sur la Ligature des principales artéres des extrémités.

[l] Loc. cit. notes, p. 10. Il paroit que l'on est actuelment convaincu qu'un anéurisme cesse d'être vrai, dés qu'il a pris un certain dégré de croissance; que les parois de l'artére amincies s'effacent, disparoissent, et que les bords de la rupture adherent fortement au tissu cellulaire, qui comprimé s'epaissit, et constitue presque tout le sac anéurismatique.

§ 29. The brittle nature of the proper coats of the arteries, especially when that disposition is rendered greater by the morbid *steatomatous*, *scaly*, *ulcerated* degeneration, does not readily permit the artery to be distended without being ruptured; it is even probable, that as in every rupture of an artery from violent exertion, the proper coats being much more brittle than their external cellular sheath, are ruptured, while the external remains entire; and this is one of the principal reasons why in aneurisms, especially of the ham and thigh from a sudden exertion, the tumour is almost constantly *circumscribed*, and resembles a *true* aneurism. But however capable of dilatation an artery may be supposed to be, it will never be so beyond a given proportion to its natural diameter. But there is no proportion between the usual diameter of the popliteal or femoral arteries and an aneurism of these arteries when they have acquired the size of a goose's egg, or of the fist. We have observed in the preceding chapter, that the greatest of all the arteries, the aorta, in the vicinity of the heart, where it has its greatest diameter, if it sometimes yields to dilatation, the dilatation never takes place but in a certain proportion with the natural size of the artery, beyond which, if the aorta is forced to enlarge, it bursts in some point of its circumference. What then would happen if the popliteal or femoral arteries, having become weakened, or too rigid, and brittle in some part of their circumference, were strongly distended by the impetus of the arterial blood? Whoever has had an opportunity of dissecting aneurisms of the popliteal artery, cannot fail to have seen, that the two orifices of the artery are never situated at the two extremities of the sac, but on one side, and sometimes at a little distance from one another; that is, the superior orifice of the ruptured popliteal artery is as far distant from the inferior as the size of the rupture in it, which sometimes extends an inch or an inch and an half in length. If it were true that the aneurism was formed by the dilatation of the proper coats of the artery, since the bloody tumour is constantly formed on the one or other side of the artery, and never comprehends the whole circumference of the tube, it would be necessary to suppose, that the portion of the anterior or posterior side of the artery equal to an inch and an half in extent, and sometimes much less, was susceptible of such a dilatation as to form a sac of the size of a goose's egg or of the fist in the cavity of the ham, which, comparing the small extent of the distended side of the artery with its small density and capability of extension, approaches to perfect absurdity. That the popliteal or femoral aneurism is never preceded by dilatation at the place of the disease of the proper coats of the artery, is proved by the inspection of the disease, as well as by the careful comparative dissection of the coats of the artery and those of the aneurismal sac, the first of which are muscular, the latter wholly cellular; and it is further confirmed from the artery constantly preserving its cylindrical form both above and below the root of the aneurism; whilst, if the artery formed the aneurismal sac before being ruptured, it would be always found at some distance above the tumour, of a funnel shape, the base of which would be in the sac, the apex in the superior orifice of the artery. But the contrary of this is always observed, and the popliteal and femoral arteries are always found to preserve their cylindrical form immediately above the root of the sac, into which the artery has rather the appearance of penetrating farther, than of expanding its coats to form the parietes of that receptacle of the blood, and to take a part in its formation. The figures published by Walter[m] and by Guattani[n] shew clearly the truth of this fact, and confirm still more what has been said above with regard to the true nature and proximate cause of the popliteal and femoral aneurisms.

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[m] Observ. Anatom. Tab. viii, M.

[n] Oper. citat. Tab. v, fig. i, M. M. Tab. ii, fig. ii.

§ 30. With regard to the structure and connexion of the aneurismal sac of the ham with the neighbouring parts, it is proper to remark, that the sac is always formed in part by the cellular sheath surrounding the artery, and partly by an aponeurotic layer of the muscle of the *fascia lata*, or by the aponeurosis of this muscle spread immediately below the integuments of the ham. This aponeurotic web of the ham, although not so dense as that covering the lateral part of the knee, is nevertheless sufficient to resist strongly the distension which may be made from within outwards, and the more so, as it receives in the cavity of the ham an addition of several ligamentous filaments artificially interwoven with it, which run across obliquely from one side to the other. These ligamentous bands include on both sides of the ham the insertions of the tendons of the flexor muscles of the leg, and serve to protect the parts which run in the cavity of the ham, and also contribute to prevent the too great separation of the tendons of these muscles. Under these ligamentous bands, in the sound state of the parts, the popliteal nerves, the vein, and still deeper the artery, are found united together by means of a dense compact cellular substance. Between the popliteal artery and the posterior surface of the femur, the cellular substance is weaker and less compact than on the anterior surface, where it is covered by the ligamentous bands and by the integuments. On which account, the internal coat of the popliteal artery being ruptured or corroded, the blood oozes through the muscular coat, and is effused into the cellular sheath, like an ecchymosis, and is afterwards raised in the form of a tumour. The resistance opposed to the effusion of blood being made partly by the cellular membrane, partly by the ligamentous bands, which, as I have mentioned above, also oppose the separation of the tendons of the flexors of the leg, it therefore happens that the popliteal aneurism assumes rather an elongated form, according to the longitudinal axis of the knee, than a round figure. And as the cellular sheath of the popliteal artery is weaker and less dense on the side next to the posterior and inferior surface of the femur, than on the opposite or anterior side, therefore it more commonly occurs that the aneurismal sac is large and dense on the side of the integuments, while it is thin on the side corresponding to the bone, and sometimes wanting, as in the large popliteal aneurisms of long standing, in which the clots of blood are very often found in contact with the periosteum, and sometimes with the substance of the femur and its condyles.

§ 31. The femoral artery also, in its long course from the crural arch to its passage through the tendon of the long portion of the adductor magnus, is covered by the aponeurosis of the muscle of the *fascia-lata*, but not equally so in the whole of this course. For, the portion of this artery extending for about four inches below the crural arch, is surrounded by a cellular membrane much denser than lower down, being a continuation of the cellular membrane which lies behind the peritoneum, and accompanies the crural vessels without the abdomen for a certain space, known formerly under the name of *processes* of the *peritoneum*. Farther, the femoral artery, at the top of the thigh, is protected anteriorly by an aponeurotic layer of the fascia-lata, much thicker and denser than that covering the artery at the lower part and in the rest of the thigh. On which account the femoral aneurism, which forms at the top of the thigh, retains very often for a long time its *circumscribed* form, and increases more slowly than that which occurs in the middle or lower part, where the artery, being surrounded by a cellular substance very capable of distension, and not sufficiently supported by the aponeurosis as at the upper part, allows the effused blood more easily to elevate the integuments, and sometimes to proceed backwards between the bundles of the adductors of the thigh, as far as to press upon the great sciatic nerve, and injure it sometimes so much as to make the patient lose the sensation and motion of his inferior extremity. This point deserves the most attentive consideration, as it has great influence both upon the prognosis and plan of cure to be adopted for the radical cure of the femoral aneurism.

§ 32. The marks by which surgeons generally[*] conceived it to be possible to distinguish a *true* aneurism, or aneurism from *dilatation*, from a *spurious*, or an aneurism from *effusion*, have never existed, if I may be permitted to say so, except in the brain of those who have proposed them. They say, that the *true* popliteal or femoral aneurism may be distinguished from the *spurious*, because the former at its commencement is small, circumscribed, indolent, without any change in the colour of the skin covering it, easily compressed, but, on removing the compression, immediately re-appearing as before; that it augments slowly, and in proportion as it increases, the pulsation in it becomes weaker and obscure, until it disappears entirely; which appearances are said to be reversed in *spurious* aneurism, with the farther addition of a kind of hissing noise, where the strong pulsation declines, and in retiring from the centre of the aneurism, a sort of small trembling or oscillation, which i not met with in *true* aneurism. But nothing can be more inconsistent with the truth than this account of the symptoms characterizing true aneurism. We may have a most convincing proof of this in the aneurisms from the puncture of an artery, in which, if the wound has been very small, the same symptoms present themselves as in the *false* aneurism so called, which have been considered as proper and peculiar to the *true* aneurism, although there be nothing more certain than that the tumour has been formed by a puncture and effusion of arterial blood. Whenever the laceration or ulceration of the internal coat of the artery from an internal slow morbid cause, is not extensive so that the blood oozes slowly through the interstice of the fibres of the muscular coat, and when the cellular substance surrounding the artery is dense, and sufficient to resist the impulse of the arterial blood which endeavours to expand, the pulsating bloody tumour remains small and circumscribed, with very little pain, without any discoloration of the skin covering it, compressible and elastic. But in proportion as th rupture or ulceration of the artery increase in size and the cellular substance surrounding it yields to th infiltration and distension produced by the effuse blood, the tumour necessarily increases, loses the flexibility and elasticity which it had at the beginning, and the numerous firm layers of blood, which form in it, at last render the pulsation also obscure. A further proof of the fallacy of the common doctrine of the distinctive marks of the *true* and *false* aneurism, may also be deduced from the fact, that in those cases in which the pulsating tumour of the artery is formed by a *steatomatous* thickening of its proper coats, the aneurism is hard and incompressible, precisely as the aneurism from *effusion* is said to be, although in the former case it has been demonstrated, that there is a very inconsiderable effusion of blood into the cellular substance surrounding the artery, or at least nothing more than an ecchymosis.

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[*] Petit. Mém. de l'Acad. R. des Sciences de Paris, an 1736, pag. 244. Petit, after enumerating the characteristic marks of true and false aneurism, adds; les différences characterisent si parfaitement ces deux maladies, qu'il semble qu'on ne devoit jamais prendre l'une pour l'antre. C'est cependant ce qui arrive queiquefois. J'ai observé plusieurs fois, qu'un anéurisme par dilatation peut paroitre et même devenir anéurisme par épanchement, et qu'un anéurisme par épanchement peut paroitre anéurisme par dilatation.

§ 33. The very acute pain, and the swelling and torpor of the leg, which sometimes accompany the popliteal and femoral aneurisms, are not, properly speaking, occasioned by the morbid state of the proper coats of the artery, but by the pressure exercised by the effused blood upon the parts surrounding the affected artery. The aneurism of the ham, or of the thigh, on its first appearance, and when it is small, occasions little or no inconvenience; but as soon as the quantity of effused blood makes a considerable addition to its size, it occasions violent pain, gives great uneasiness to the patient from the violence of its pulsation, especially if the patient is plethoric, and does not submit often enough to venesection; and it at last produces the swelling and torpor of the leg. The small *steatomatous* throbbing tumours in John Parker, which were taken for so many *true* aneurisms, did not, for a long time, excite any remarkable inconvenience to the patient, but immediately after the one in the right ham burst, and actually gave rise to an aneurism, the pai appeared, and the leg began to swell. The patient whom Guattani[p] speaks, continued pretty well for tw complete years; but as soon as the patient perceiv the repeated crack of something in his thigh, and sound similar to the tearing of a bit of cloth, the t mour increased rapidly by the effusion of blood, t pain was most acute, with enormous swelling of t whole limb. Even independent of the *steatomat* thickening of the proper coats of the artery, in a ca of slow ulceration of these coats, especially the int nal one, as long as the rupture is small, and the c lular sheath of the artery sufficiently resistent, a strengthened by the ligamentous bands, and aponeuro layers, so that the effused blood remains *circumscrib* within a small space, the pain in the seat of the d ease, and the swelling of the leg, do not incommo the patient, and are of little consequence. But soon as the ulceration and corrosion[q] of the intern coat of the artery have made a certain progress, a the rent in the artery is enlarged by the increased i petus of the blood, or by a violent exertion, the tumo quickly acquires an increase of size, and the viole symptoms above mentioned arise, from the strong d tension of the adjoining parts, and the compression the great femoral and popliteal nerves. In the inv terate, and enormously large aneurism of the ham, t great popliteal nerves are always found stretched the convexity of the aneurismal sac, of a reddish c lour, tinged with blood, hard, and converted into large compact filamentous expansion, and incapable supplying vitality to the leg and foot.[r]

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[p] Loc. cit. Singulare femoris aneurysma, hist. v.

[q] Guattani, p. 192, fig. 4.

[r] Guattani, tab. v, fig. 1, *g g*.

§ 34. From the series of facts detailed in this chapter, it follows, 1, That the proximate and efficient cause of the popliteal and femoral aneurisms, as has been mentioned in treating of the aneurism of the aorta, is always the *rupture* or the *ulceration* of the proper coats of the artery; 2, That the cause of this rupture is some violent exertion combined, for the most part, with a congenital relaxation, or with a *steatomatous* or *ulcerated* degeneration of some portion of the proper coats of the artery, and more particularly of the internal coat; 3, That the *steatomatous*, *squamous*, *ulcerated* disorganisation of the proper coats of the femoral and popliteal arteries, takes place sometimes in one point only of the artery, sometimes in several places, and at different distances from each other, in the whole course of these arteries; 4, That the marks regarded as characteristic of the distinction of the *true* from the *false* aneurism, are inadmissible, and are contradicted by the known nature and characters of this disease, and by the attentive observation of the phenomena which accompany it; 5, That no other distinction ought to be admitted in the doctrine of aneurism, than that of *recent*, and *inveterate*, *or of long standing*, *circumscribed*, and *diffuse*.

CHAPTER VII.

OF THE ANEURISM OF THE BRACHIAL ARTERY.

§ 1. SURGICAL writings contain many histories aneurism in the bend of the arm, produced by puncture of the brachial artery in venesection, caused by a deep wound inflicted at the bend of arm, along the inner side of the humerus, or in axilla. No doubt certainly can exist with regard the nature of this aneurism ; it is evidently forn by *effusion*. Although Morand[a] and some other s geons have found that, along with the aneurism ca ed by the wound of the brachial artery, the diame of that vessel is sometimes unusually enlarged throu its whole length, above the seat of the tumour ; t enlargement, which is a very rare occurrence, mi have existed naturally, and before the puncture of t artery. And if it even happened frequently, it cou not with justice be said, as I have remarked in seve places, that the increase of size of the trunk a branches of an artery lengthwise, is essential to co stitute an aneurism, and still less, that to this eq ble enlargement of the tube of the brachial artery w to be referred the formation of the aneurismal sac the bend of the arm, along the inner side of the h merus, or in the axilla, in consequence of a punctu or wound of the brachial artery.

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[a] Mém. de l'Acad. R. de Chirurg. t. v, pag. 167, 8vo.

§ 2. It cannot fail, therefore, to excite surprise,[b] that men acquainted with anatomy, and experienced in surgery, such as Molinelli,[c] Guattani,[d] and so many others, who had undoubtedly had frequent opportunities of examining the aneurism in the bend of the arm, caused by the puncture of a lancet, should have persisted in the belief, that the tumour was formed by the dilatation of the proper coats of the brachial artery; and that following these false principles, they, in the act of operating, should have taken the trouble to separate the aneurismal sac carefully from the neighbouring parts, as if it belonged properly to the artery, and were formed by the dilatation of its proper coats. Mr. Magill,[e] preoccupied by this false opinion of the nature of this disease, attempted to effect this separation in the act of operating on an aneurism at the bend of the arm, caused by an unfortunate venesection; but as he observed that the operation did not go on well, and was even very difficult and troublesome, from the capsule containing the clots of bloo adhering everywhere very firmly to the surroundin parts, and being in some points very thick, and in othe thin and easily lacerated, he adopted the better pra tice of dividing the sac, and evacuating the grumou blood. After this, he immediately discovered, at th bottom of the sac, the precise place where the arter was punctured. Dr. Monro, who was present at th operation, said,[f] that he had before had strong re sons for believing that the true aneurism was a ver rare disease, yet on seeing the tendinous aponeurosis the bend of the arm laid bare, he had for a mome almost changed his opinion, for this aponeurosis see ed to be the muscular coat of the artery dilated lik an aneurismal sac. Dr. Monro adds, I would hav fallen into this error, if Mr. Macgill had at once d vided the tumour in its whole length, instead of sep rating the aponeurosis from the neighbouring part It is not improbable that several other surgeon among those who have taught that true aneuris sometimes occurs at the bend of the arm after ven section, have been likewise deceived by the aponeu rotic membrane of the bend of the arm, which a sumes the appearance of a fibrous layer lying ove the aneurismal sac, and so strongly adhering to i that it can with difficulty be separated.

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[b] Lassus writes very well on this subject, Med. operat. t. 11, pag. 426. Ce sont les mauvaises définitions qui ont contribués plus qu'on ne le croit à perpetuer l'erreur. On s'est laissé conduire par les mots que par les choses, et l'on a mieux aimé redire une erreur, que de prendre la peine de verifier si ce que l'on disoit étoit vrai ou faux.

[c] Comment. Acad. Bonon. t. 11. Cum mihi observationes aliquot in promptu essent, ad vera præsertim cubiti aneurysmata pertinentes ob læsam forte inter mittendum sanguinem a chirurgo brachialem arteriam oborta. Atque ut sacci internam faciem omittam cum interna arteriarum facie maxime congruentem, arteriæ utique in saccum explicari ipsæ, extendique conspiciebantur.

[d] Loc. cit. Hanc autem partium separationem, etiam in posteriori tumoris sede, eousque peregi, donec validum in nervum inciderim, qui arteriam contigue comitatur, et donec membranis omnibus et musculis tumorem ita extricaverim, ut eum possem superius, atque inferius vinculis coercere.

[e] Medical Essays of Edinburgh, vol. ii.

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[f] Monro's Works, N. 14. Notwithstanding my theory an dissections had brought me to think true aneurisms to be at least very uncommon disease, yet when I saw Mr. Macgill lay the te dinous aponeurosis bare, I was ready to have renounced my op nion, being persuaded it was the muscular coat of the artery; ti he most dexterously prosecuted the aponeurosis to its rise from th biceps, and so fully convinced me of the mistake into which should most readily have been led, without discovering it, if th operation had been performed in the more speedy way of laying th whole tumour open by one incision.

§ 3. But what, in my opinion, has more than any thing else given credit to the possibility of the formation of *true* aneurism in the bend of the arm after venesection, was the theory of those who supposed, that whenever the lancet only penetrates the cellular membrane and the muscular coat of the artery, leaving the internal coat entire, the aneurismal sac is formed by the internal coat, which is forced gradually outwards by the blood, between the lips of the wound of the two external membranes of the artery superficially injured. Guattani[g] considered this as a certain fact, and compared the distension and protrusion of the internal membrane of the artery to that of the peritonaeum in the formation of an hernial sac. This is the reason, he says, why the aneurism at the bend of the arm appears sooner or later after the wound, and without producing any change in the colour of the integuments, and why it assumes a round form, and throbs strongly. To understand fully the invalidity of this doctrine, it is only necessary to have examined the structure and properties of the internal coats of the arteries, the thick and brittle texture of which does not support any considerable degree of distension without being ruptured. On injecting air forcibly into an artery which has been for a long time macerated and deprived at different places of its muscular coat,

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[g] Loc. cit. Prout in missione sanguinis ex basilica vena, magis aut minus alte demergitur scalpellum, non raro pertudi arteriam contingit. In illa autem si ferri mucro ad cavum usque haud pertingat, sed ex quinque arteriarum componentibus tunicis duas tantum aut tres confodiat, verum progignitur aneurysma. Imminuto enim in vulnerata sede adverso conatu, arteriosus sanguis integras adhuc membranas jugiter feriens, eas pedetentim ita distendet, ut herniosae tandem reddantur, indolentemque ocyus, seriusve pariant tumorem, qui non solum nativo gaudebit colore partis, et rotunda, vel ovali figura, sed sensibili quoque, eaque sat valida pulsatione.

small pellucid vesicles arise in these places, formed
the internal coat of the artery, and these vesicles re
ly break, if the air is forced in with a little more
lence. But in the recent unmacerated artery, not e
these small vesicles are formed, and the internal coa
the artery is ruptured by the impulse of the air, with
forming any protrusion. Some observations made
Haller[a] on the mesentery of frogs, appear to me
have contributed to give credit to this doctrine.
these observations he asserted, that he had seen
aneurisms formed in the mesentery of frogs, and t
he had himself produced them artificially, by insu
ing and stretching the arteries of the mesentery,
making an incision into them with the point of a l
cet. But is it certain and demonstrated, that Hal
in these fine microscopic observations, had comple
stripped any of the arteries of the mesentery of
frogs, of the whole cellular substance surrounding
Is it proved, that in stretching the mesentery u
the apparatus of the microscope, he had not ruptu
some ramification? That no rupture had happened
the act of insulating or stripping, as he expresses
the artery which in the sequel becomes aneurismati
And admitting, (which is far from being prove
that by this kind of experiment he had seen *true* an

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[b] Deux Mémoires sur le mouvement du sang. Mém. i, p
C'est mal à propos que quelques écrivains ont cru dévoir retran
l'aneurisme vrai du nombre des maladies chirurgicales. Je l'ai
se produire, comme je l'ai deja dit, sans pouvoir en assigne
cause, et j'ai appris dans la suite à le produire aussi souvent
je l'ai voulu. Je separe pour cela les deux lames du mésentere
deux cotés d'une artere, je la secoue ensuite de la maniere à la
gager tout à fait des liens celuleux qui l'affermissent; et je ne t
pas aprés ces preparatifs à voir naitre un aneurisme, qui se fo
egalement aprés une incision, et surtout aprés la piqûre de l
tere.

risms produced under his eye, it does not follow, that those, which he had caused to arise by means of the incision or puncture of one of these arteries, deserve such an appellation, where, if an aneurism had been formed, it could not have been produced in any other way than by the effusion of the arterial blood into the cellular membrane surrounding the punctured artery.

§ 4. The fallacy of this opinion appears still more clearly from the following experiments.[a] Mr. Hunter having laid bare the carotid artery of a dog for the space of an inch and an half, and having separated at the same time the external cellular sheath from the artery, and then the muscular coat, layer after layer, until the remaining coat of the artery was so thin, that the blood could be seen shining through it, he left the dog at liberty. Three weeks after, the dog was killed, and on examining the neck, it was found that the lips of the wound had contracted and closed over the artery ; that all the parts surrounding the place of the incision had consolidated, and formed a strong knot of re-union with the artery ; that finally, the carotid artery, in the whole space where it had been stripped of its cellular sheath, and of the greater part of its muscular coat, had neither diminished nor increased in diameter. It has been objected to this fact, that the lips of the wound having been left to themselves, had immediately closed upon and covered the denuded and weakened portion of the artery, and that this had secured it against any rupture, and the aneurismatic dilatation. In order to ascertain the importance of this objection, Mr. Home instituted the following experiment. He laid bare the femoral artery of a dog, about two inches below Poupart's ligament, for about an inch in length. He separated and dissected off as much of the muscular coat of the artery as was sufficient for seeing the blood circulating within it, through its pellucid internal coat. The lips of the wound were kept separated by the interposition of dressings. The dog did not shew any signs of being much incommoded by the wound, and it was cured by the second intention. After six weeks the dog was put to death; and the femoral artery was then injected, that it might be examined with the greatest possible accuracy. It was found, as in Mr. Hunter's experiment, that the artery had neither increased nor diminished in diameter at the place where it had been weakened by the separation and removal of the muscular coat. I have also repeated this experiment twice; first on the carotid of a large dog, and secondly on the carotid of a sheep, by dissecting off the muscular coat, layer after layer, until the internal coat appeared quite bare, and by the interposition of lint I brought the wound to suppuration, and healed it by the second intention. Four months after the cure, I observed in both animals, that the carotid artery, in the whole of the space from which the muscular coat had been removed, was surrounded by a puffy, hard cellular substance, adhering firmly to the internal coat of the artery, which at first sight, on viewing it externally, appeared to be a little enlarged in size; but on opening it on the opposite side, lengthwise, I distinctly observed, that the canal of the artery was neither increased nor diminished in diameter, and that the external swelling depended entirely on the thickened and indurated cellular substance, which surrounded it at the place corresponding to the cicatrix.

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[a] Transactions of a society for the improvement of medical and chirurgical knowledge, pag. 144, vol. i.

§ 5. The proximate cause, therefore, of the aneurism which is formed in the bend of the arm after venesection, as also that which occurs in the brachial or axillary artery, produced by a wound, may invariably be traced to the incision or solution of continuity of the two proper coats of the artery, and the consequent effusion of blood into the cellular substance surrounding the injured artery. The effect is the same, whether from an internal morbid affection, capable of ulcerating or corroding the internal and fibrous coats of the artery, the blood be effused into the neighbouring cellular sheath surrounding the artery, which it raises after the manner of an aneurismal sac, or, the wound of the integuments having closed, the blood issue from the wounded artery, and be diffused in the surrounding parts. The solution of continuity in the integuments, cellular membrane, and aponeurosis covering the artery, consolidates quickly in these cases; while, on the contrary, the proper coats of the artery remain separated at the place of the puncture or wound; and therefore, as was observed by Hildanus and Sennertus,[1] the arterial blood not finding any longer a direct way to spring outward, through the integuments, infiltrates, as in the internal aneurisms produced by the ulceration or corrosion of the internal coat, into the cellular substance, covering externally the wounded artery, and fills it in the manner of an *ecchymosis*; it then distends and elevates it in the form of a tumour, and the cellular divisions being destroyed, converts it at last into a firm capsule, or aneurismal sac.

§ 6. I have said, in another place, and it is proper to repeat it, that the greater or less resistance opposed to the impetus of the blood, during the time of its extravasation or effusion, by the interstices of the cellular substance surrounding the artery, by the ligamentous fasciæ and aponeuroses lying over the aneurismal sac, is the true reason why the aneurism sometimes presents itself under the form of a small *circumscribed*, and sometimes of a large and *diffuse*, tumour. The rapidity or slowness of the formation, and appearance of the tumour outwards, likewise depend upon the same cause. For, with regard to the aneurism at the bend of the arm, it may be remarked, that it scarcely appears, or is small and stationary, whenever the puncture made in the artery is very minute, and the inflammation excited by the stimulus of the effused blood, or by the artificial pressure made upon the cellular substance surrounding the injured artery, has contracted its cells, and produced such an adhesion of it to the artery, and to the ligamentous and aponeurotic fasciæ, as to oppose a strong obstacle to the further exit of blood, and to the formation of clots. On the contrary, if, by the size of the wound inflicted in the proper coats of the artery, the column of blood which issues from it is large, and vibrating strongly, if the cellular substance surrounding the wounded artery is loose, and easily distended, and if the ligamentous aponeurotic fasciæ only oppose a weak resistance, the aneurism appears suddenly outwards, and increases and dilates rapidly. And even in those cases, in which the aneurism at the bend of the arm was at its commencement very small and circumscribed, and has remained long stationary, if the wound of the artery is enlarged by an exertion of the arm, by a blow inflicted on it, or by the increased impetus of the blood in the brachial artery, so that the column of blood, endeavouring to issue out, overcomes the resistance of the cellular membrane, and of the ligamentous aponeurotic layers at the bend of the arm, the aneurism, from being very small and stationary, is suddenly elevated, increases rapidly, and threatens to become diffused along the inner side of the humerus, and rises up as far as the axilla in the course of the humeral artery. It is observed in the *circumscribed* aneurism, that the disposition of the polypous concretions, filling the sac, varies according as the aneurism, which was small at first, has increased in bulk slowly, and at intervals, or has acquired a prodigious size all at once, and soon after the artery was wounded, In the first case, the bloody thrombus, or *couvercle*, as Petit calls it, having adhered to the artery opposite to the lips of the wound, stops the effusion of the blood. Some time after, the impetus of the blood detaches this *couvercle* on the one or other side, pushes it aside, and forms a new coagulated layer over the first, then a third layer over the second, and so on successively, and in proportion to the bulk which the tumour acquires. Of all these layers, disposed in the manner of concentric circles, the first being the nearest, and still in part adhering to the artery, is the smallest, and the most compact. In the second case, the thrombus is not properly in layers, but rather in form of a concrete mass; and what has been said here on the subject of aneurism of the brachial artery, in consequence of the puncture of a lancet, is understood to be applicable to the aneurism of the femoral and popliteal arteries, according as the aperture from which it is derived is small or large, and the formation and increase of the tumour slow or quick.

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[1] Chapter v, § 9.

§ 7. Surgeons have generally taught, that in the bend of the arm, at the usual place of bleeding, it is the aponeurosis of the biceps muscle, covering the cellular substance which surrounds the artery immediately under the integuments, which opposes more strongly than any other ligamentous or aponeurotic sheath, the augmentation and quick increase of the aneurism at this place. This opinion appears to me to have originated from inattention: for the aponeurosis of the biceps, where it leaves the tendon of this muscle, is not more than half an inch in breadth.[k] It then descends obliquely, from the outer to the inner side of the arm, enlarging gradually; but it does not form a broad expansion, until a good way below the bend of the elbow, and it does not begin to cover the heads of the radialis *internus*, palmaris *longus*, and ulnaris *internus* muscles, till about three inches below their origin from the internal condyle of the humerus; that is, in other words, far below the bend of the arm. From which circumstance, the aponeurosis of the biceps, being situated lower than the place where venesection is usually practised, can, in the greater number of cases at least, contribute but little or not at all to strengthen the cellular substance surrounding the injured artery, and therefore cannot oppose the rapid increase of the aneurism; and it is the less capable of doing so, as has been said, from its not being more than half an inch in breadth, where it crosses the bend of the arm.

§ 8. In examining the bend of the arm immediately below the integuments, there is nothing which I find contributes so much to increase the resistance of the subjacent cellular substance, as a fascia or ligamentous web or expansion, which, after having covered the body of the biceps muscle, extends itself over the whole course of the humeral artery, and is firmly implanted into the internal condyle of the os humeri.[l] This ligamentous expansion has a triangular shape, the base of which extends from the tendon of the biceps muscle, to the internal condyle of the os humeri, and the apex of it is extended on the inner side of the humerus towards the axilla, in the course of the humeral artery. Immediately under the integuments, this triangular ligamentous expansion adheres to the skin; more deeply, it forms a kind of duplicature, or elongation, which is inserted into the os humeri lengthwise, just at the space left between the origins of the brachialis muscle, and the two lower heads of the triceps extensor of the arm. The humeral artery and the median nerve, kept in their situation by the cellular sheath and this ligamentous expansion, run in the furrow formed between it and the internal margin of the biceps muscle. The base, or inferior portion of this triangular ligamentous expansion, becomes larger and firmer the nearer it approaches to the internal condyle of the humerus; and before being inserted into this condyle, it forms as many folds and sheaths as there are heads of muscles attached to it. And since this ligamentous web has a triangular form, with its base in the bend of the arm, and the vertex in the axilla, it follows of course, that below the base of this expansion, there is an oval space[m] filled with cellular substance, the transverse extent of which, is equal to the distance between the tendon of the biceps muscle and the internal condyle of the humerus. This oval space goes on gradually contracting, the farther it ascends from the bend of the arm, along the internal margin of the biceps muscle towards the axilla, where it terminates in a point.

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[k] Camper. Demonstr. Anat. Patholog. tab. ii, fig. 1, 11. Haller Fascicul. Anat. vi, tab. iii, fig. 4, i. Bicipitis tendo superficialis.

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[l] Sabatier gives the name of intermuscular ligament to this ligamentous web. Traité d'Anat. t. i, p. 290.

[m] Camper. loc. cit. Fig. 1, E, L, S. Fig. 11, C, D, E, F.

§ 9. This disposition of the parts shews, why the aneurism which forms in the bend of the arm in consequence of venesection, for the most part assumes an oval figure, exactly similar to that of the cavity, extending below the ligamentous web, from the tendon of the biceps muscle, to the internal condyle of the os humeri; and likewise, when the aneurism arising from the puncture of a lancet becomes *diffused*, why it extends from the place of the venesection upwards rather than downwards, and rather along the internal than the external side of the humerus. It farther explains, why this *diffuse* aneurism takes the form of a triangle with the base in the bend of the arm, and the vertex towards the axilla, along the course of the humeral artery. For, attending to what has just been said, the blood which runs along the interstices of the cellular sheath surrounding the humeral artery, is at last inclosed within a triangular space, formed on one side by the internal margin of the biceps muscle, and on the other by the prolongation of the ligamentous web, inserted lengthwise into the humerus. And it is observable, in this case, or in the *diffuse* aneurism, that the clots of blood are found for a certain way in contact with the periosteum of the humerus, in the space between the origins of brachialis muscle, and the inferior portions of the triceps extensor of the arm; while in the first case, or in the *circumscribed* aneurism, which occupies only this oval cavity, the clots of blood do not rest, properly speaking, on the denuded articular ends of the humerus, but rather on the fibres and heads of the brachialis, triceps extensor, and pronator teres muscles; in which respect, the *circumscribed* aneurism in the bend of the arm differs remarkably from that in the ham, as in the latter the posterior surface of the aneurismal sac is immediately in contact with the periosteum covering the posterior and inferior surface of the os femoris.

§ 10. In consequence of the limits fixed by nature to the ligamentous *intermuscular* expansion of the humerus, it follows, that the aneurism caused by a wound or ulceration of the internal coat of the axillary artery above the apex of this triangular ligamentous expansion, will be always *diffused;* since all this portion of the brachial artery is only surrounded by a loose soft cellular substance, and not strengthened by any aponeurotic or ligamentous expansion. The aneurism from a wound of the humeral artery will likewise be *diffused*, whenever the artery has been wounded or ulcerated laterally, so that the blood passes out of the triangular space above described, and from thence into the cellular membrane, which keeps united the bodies of the muscles placed along the humerus.

§ 11. In the aneurism at the bend of the arm in consequence of venesection, it is the trunk of the humeral artery which is punctured, unless in those cases, which are not very frequent, where the division of the artery takes place high up, and, as sometimes occurs, in the vicinity of the axilla. I have convinced myself repeatedly of the truth of this fact, by putting in pins, as Dr. Monro did, into the place where venesection is usually performed, and more especially by introducing them through the cicatrix of former bleedings. In all these experiments I have found, that the pin pierced the trunk, or in the immediate vicinity of the trunk of the humeral artery, above its division into radial and ulnar, or entered the radial artery under the median vein; but so near to the origin of this artery, that the injury, in the living state, might have been regarded as made in the trunk of the humeral artery.

§ 12. It is a thing worthy of remark, that while aneurisms are not unfrequent in the aorta, and in the great artery of the thigh and ham, from an internal cause, or from a morbid disposition of the artery, especially of its internal coat, aneurisms of the brachial artery from an internal cause, such as the *steatomatous*, *ulcerated*, *earthy* degeneration, are very rare. It is not easy to give a reason for this difference; even if we are willing to admit, that the arterial system, the farther it proceeds from the heart, the more it loses its vitality, and capability of resisting the internal and external causes which may produce a solution of continuity in it; and if we even allow, that the inferior extremities are more exposed to external injuries, and to violent exertions, than the superior. Notwithstanding all this, the superior extremities are not exempted from this affection, and we have some examples of aneurism of the brachial artery, arising from an *internal* cause, or caused by an ulceration and rupture of the humeral artery independent of wounds, which I shall now relate.

§ 13. Thomas Cook,[a] a soldier of the 3d regiment of foot-guards, in the beginning of the year 1759, perceived a swelling in the vicinity of his left arm pit, for which he could assign no cause; as he had never received any contusion on that part, nor overstrained himself. Mr. Fordyce, the surgeon, discovered it to be an aneurism, but had not courage to attempt the cure of it. In the meantime the tumour went on daily increasing, and the patient was directed to S^t. George's hospital. The swelling extended down in the course of the brachial artery, and had an evident pulsation. The physicians and surgeons of the hospital were of opinion, that it was not proper to attempt any operation, as they thought the tumour was situated too high up; and they therefore advised the employment of no other remedies but palliatives and anodynes. After this, the tumour increased greatly along the internal side of the humerus, and the pulsation gradually ceased. In the beginning of December, the aneurism burst, and the patient died of the hemorrhage. In the dissection of the body, it was found, that the brachial artery had been ulcerated and lacerated near the axilla; that the large aneurismal sac seemed at first sight to be formed by the coats of the artery, though in reality it was not so; that the tube of the artery was but very little enlarged in diameter, where it opened into the aneurismal sac; that the brachial artery was impervious for about half an inch below the rupture; and lastly, that the radial and ulnar arteries were pervious, but somewhat smaller than usual.

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[a] Essays and Observ. Phys. and Liter. of Edinburgh, vol. iii, case 11, tab. 2.

§ 14. 'A nun,° of a scorbutic habit, and who had 'been subject to frequent palpitation of the heart, and 'spitting of blood, perceived one day a crash in her 'left arm as if a sinew had burst, to use her own words,

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° Paletta. Giornal. di Venezia. Marzo 1796.

‘and from that moment a small tumour formed a the inner part of the arm, a little above the interna condyle of the humerus, which pulsated, and wa circumscribed without any œdema externally. Th whole brachial artery pulsated, and its motions wer quite evident to the eye. The arm, however, wa feeble and a little wasted. Theden’s bandage applied to the fingers and arm was of no sensible advantage, but still less in the sequel, when in descending a stair, she broke the lower extremity o the left humerus, at a little distance from the aneurism. This accident, in addition to the pain, brought on a soft œdematous swelling of the fore arm and hand, which did not disappear until some time after the perfect consolidation of the fractured bone, which was accomplished in 45 days. In the meantime, the aneurism had enlarged very much, and became more painful, and the pulsation changed into a reciprocal motion of the blood from the aneurism to the heart, and from the heart towards the aneurism, with a troublesome sense of oppression. With the successive increase of the pain, the veins of the fore arm and hand became turgid; the aneurism, and then the fingers, became livid; and having lost all power of supporting the arm, it fell like a piece o lead upon the bed when it was raised. The aneurism afterwards extended over the whole lower extremity of the humerus; which, conjoined with the most violent pulsations and frequent faintings, accelerated the death of the patient.’ Although the dissection of the body was not performed, the author had no doubt, that this aneurism was occasioned by the ulceration and rupture of the brachial artery.

§ 15. 'Alexander Meniconi,[p] a young man, of a plethoric temperament, in lifting a heavy weight from the ground, suffered a violent sprain of all the muscles of the right arm, and particularly of the flexors of the fore-arm. For many days he was unable to make use of the elbow joint, on account of the pain, and a kind of lividity which appeared the following day on the inside of the arm. He kept it at rest, and applied for several days compresses dipped in vinegar and water. The pain gradually abated, the discoloration went off, and he resumed his trade of a carrier. He continued in his employment for six months, using his arm freely. After this time he began to feel some pain when he raised any weight from the ground. The pain increased to such a degree, that he could not make use of his arm any longer. Although he had observed for some months a small swelling above the bend of the arm, he never supposed that the pain could arise from it, as it was of the natural colour, and indolent. One day, having met in the street a physician from Colonna, his native country, he told him of his uneasiness, and shewed him the tumour. This physician, after having examined it, told him it was a dangerous swelling. He continued nevertheless to make use of his arm; but at last the swelling having increased considerably, by the advice of the same physician he came into this hospital to be cured. I found, on inspecting the part, about three inches above the inner condyle of the humerus, a tumour of the size of a large nut, soft, of a brown colour; and on compressing it with my fingers, it partly disappeared, and was accompanied by a pulsation cor-

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[p] Flajani. Collezione d'osserv. e rifles. di chirurgia, t. ii, pag. 22, osserv. vii, of a true aneurism of the right arm.

‘ responding to the systole and diastole of the hea
‘ The patient told me, that if he kept his arm ben
‘ he did not feel any uneasiness, but felt pain if he ke
‘ it extended. The patient having assured me th
‘ he was determined to submit to any operation to l
‘ relieved from this affection, I prepared him for tl
‘ compression, as the least painful mode of obtaini
‘ a cure. I made him lose some blood, put him on
‘ low diet, and the third day applied a compress di
‘ ped in Theden's vulnerary water, and secured
‘ with a moderate compressive bandage, which e
‘ tended below the axilla, and terminated above tl
‘ condyles of the humerus. This produced son
‘ numbness in the whole arm, although it was n
‘ very tight, as the pulsation could be readily felt i
‘ the radial artery. A second bleeding appeared t
‘ me to be necessary to weaken the system, and tl
‘ following day a laxative was given, which produce
‘ an abundant discharge of bilious matter. On tl
‘ fourth day I renewed the bandage, and I found tl
‘ tumour of the same size. The compression, cont
‘ nued for 32 days, did not produce any diminutic
‘ of the tumour; it was only a little flattened, ar
‘ the fore-arm and hand became œdematous and b
‘ numbed. Dreading that the aneurism would pa
‘ into the *spurious*[q] by continuing the compression,
‘ proposed the ligature. The patient having consen
‘ ed to the operation, I immediately prepared all tl
‘ necessary apparatus, consisting of two crooke
‘ needles with waxed threads, a bistoury, hooks, a pa
‘ of forceps, a tourniquet, and the ordinary dressin
‘ consisting of caddis, compresses, and circular ban
‘ ages. The next day I proceeded to the operatio

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[q] The author considered this tumour to be a true aneurism, from a dilatation of the artery.

' The patient being brought to the edge of the bed, I ' applied the tourniquet near the axilla, which I gave ' to the care of an assistant, who supported the upper ' part of the arm; another managed the fore-arm, and ' a third handed me the necessary instruments. Having ' tightened the tourniquet sufficiently to stop the ' flow of the blood in the artery, I detached the skin ' from its adhesion to the tumour, and formed a ' transverse fold of it, and divided it by an incision, ' which laid bare the cyst of the aneurism. With the ' bistoury I extended the incision of the skin and cellular ' membrane as far as the cord of nerves and the ' artery. After having cleaned the wound of the ' blood, to distinguish the artery from the nerves, I ' made the tourniquet be slackened, and discovered ' the artery by its pulsation, under which I easily ' passed the hook with a blunt point, to separate it ' from the nerve, and with the crooked needle passed ' the waxed thread, and applied the ligature. Having ' tied the artery above, I dilated the wound at the ' lower part, and in the same manner applied the ligature ' to the artery below. The aneurismal tumour ' became flaccid, and the pulsation ceased. I applied ' a few strips of lint spread with unguentum rosæ ' over the lips of the wound, three compresses and a ' circular bandage. I loosened the tourniquet a little, ' so that the blood might pass by the collateral vessels. ' I placed the limb in a proper posture, and ordered ' him an anodyne sedative draught. He passed ' the whole day and night perfectly quiet, and the ' pulse was scarcely feverish. The second and third ' day were much the same, only there appeared a ' stain of pale blood on the dressings. On the morning ' of the 4th day I removed the bandage and the ' compresses, and left only the lint, which was stick-

‘ ing to the lips of the wound. That day he had
‘ little fever, which went off in a sweat during tl
‘ night. On the morning of the 5th, a slight puls
‘ tion of the radial artery could be felt; and on r
‘ newing the dressings, I found the suppuration est
‘ blished, and the aneurismal tumour partly suppura
‘ ed. On the 11th and 12th days the ligatures cam
‘ away, and I then slackened the tourniquet still more.
‘ On the 20th, the wound was clean, and filled with
‘ healthy granulations. On the 41st he was dismissed
‘ from the hospital perfectly cured.’

§ 16. All that I have said in this and the preceding chapter with regard to the nature and proximate cause of the aneurism of the popliteal, femoral, and brachial arteries, is likewise applicable to the aneurisms of other external arteries of the body, such as the carotid, temporal, auricular, occipital, external mammary, palmar, tarsal, and all others of a smaller size. The aneurisms of these arteries, for the most part occasioned by violent blows or by punctures, and formerly considered as *true* aneurisms, are only bloody swellings from an effusion caused by the rupture or puncture of an artery, and the extravasation of blood into the surrounding cellular substance. Sometimes, indeed, in the neck, mistakes have been committed, and a disease has been supposed to be an aneurism, when it was only an indurated gland, as the thyroid, or some enlarged lymphatic gland, which received the impulse from the carotid artery, on which it rested. Haller[r] mentions a patient, who was supposed to have an aneurism of the carotid artery, in whom after death that artery was found in a sound state. Notwithstanding this, examples and undoubted proofs are not wanting of aneurisms having happened from the rupture of the carotids. A case is related by Harderius,[s] and another by Rumlerus,[t] in both of which the pulsating tumour was formed by effusion. The first was in a soldier, in whom the carotid had been punctured; the second in a man, in whom, in the act of raising a heavy weight, and carrying his head and neck very far backwards, the left carotid burst. Several years ago I likewise saw and examined an aneurism of the right carotid in a soldier, who, having been precipitated with his horse from the walls of Mantua, suffered a most severe twist and sprain of his neck. The swelling occupied the right side, behind the angle of the jaw, extended outwards, was as large as the fist, and pulsated with great violence. Six months after, I was informed that this poor man had lost his life in the hands of an ignorant quack, who had opened the tumour, supposing it to be an abscess. In another case of aneurism of the carotid artery, Dr. Piccinelli, first surgeon of the hospital of Bergamo, my respectable friend, procured me an opportunity of examining the parts in the body after death. The history of the disease is as follows. Lucretia Boffetto, 44 years of age, was admitted into the hospital of Bergamo the 16th February 1803, on account of a pulsating tumour of the size of two hens eggs, which she had had for three months, on the left side of the neck, and which was considered to be a *true* or *incysted* aneurism. It was impossible to discover its cause. The patient could give no other account, than that scarcely three months were elapsed since she had observed this tumour in her neck, which, instead of yielding to the use of internal or external remedies, went on every day very visibly increasing. She had also for two months had a venereal ulcer on the left labium pudendi, though without enlargement of the inguinal glands, and with no manifest symptoms of lues. The patient was extremely exhausted when she came into the hospital, nevertheless it was necessary to repeat at intervals small evacuations of blood, as this was the only mode of diminishing the painful distension of the tumour, and of procuring her some relief. In spite of this the tumour increased, and occupied the space between the clavicle and the angle of the lower jaw. The 2d of April of the same year, the skin of the left side of the neck being prodigiously distended, burst, and gave rise to a round ulcer, which eroded the aneurismal sac, and laid bare the first coagulated layer of the aneurism, without being followed by hemorrhage. The 13th of the same month the skin covering the apex of the aneurismal sac began to break and to ulcerate, and the ulceration went so deep, that on the 8th May, at four in the afternoon, it penetrated the cavity of the aneurism, from which there issued suddenly twelve ounces of blood. This was sufficient to cause the woman, already much exhausted, to fall into a faint, from which she recovered, and, after having taken a little wine, she expired about midnight. On opening the body, the aneurism was found to be situated in the left carotid, the origin of which artery in this subject deviated from the common arrangement, by arising from the *innominata*; that is to say, the innominata gave off the two carotids and the right subclavian. Walter and Malacarne had already in another case observed and delineated this variety.[u] The arch of the aorta and the heart were sound; the pulmonary artery was a little larger than usual; the left carotid, from which the aneurism arose, was everywhere of its natural diameter; the aneurismal sac had formed an adhesion with the thyroid gland. On laying open the aneurismal sac from its apex, or the place of the second rupture, to the bottom, and evacuating the clots of blood, the left carotid appeared at the bottom of it ruptured on one side for the space of six lines. Between the superior and inferior apertures of the ruptured artery, its opposite sound side formed a kind of furrow. The diameter of the artery was not at all enlarged, not even at the place where it had burst. On examining these parts attentively likewise on their posterior surface, or that next the vertebræ of the neck, and on opening the left carotid lengthwise, I clearly perceived that it had preserved in its whole course its natural diameter; that the opposite side of the artery had been lacerated for the space of six lines, and that consequently its proper coats had no share in the formation of the aneurismal sac, the formation of which was clearly perceived to belong to the sheath and cellular substance surrounding the artery in the sound state. The whole of this history, especially what relates to the preservation of the natural diameter of the aneurismatic carotid artery, and the manner in which the rupture had occurred in one of its parietes, leaving a kind of furrow at the place of the injury, will, I flatter myself, contribute not a little fully to convince those who have still any doubt respecting what I have said with regard to the nature and proximate cause of aneurism in general, and in particular of that of the popliteal and femoral arteries. But to return to the aneurism of the carotid, if we reflect that this artery, both the common and cerebral, has, like all the other arteries, not only its cellular sheath, but that this sheath is denser, firmer, and more elastic than that of any other external artery of the body, and that this dense firm elastic covering strengthens greatly the canal of the artery, and maintains it in its particular and unvaried course, it may be easily understood why, when this artery is punctured or lacerated in any part, it occasions an aneurism, which increases slowly, and retains for a long time the form of a *circumscribed* tumour, although in the neck there be all those circumstances which would rather dispose to the formation of a *diffuse* aneurism.

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[r] Opusc. Patholog. Obs. vi.

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[s] Observ. in Apiario, observ. 86.

[t] In Welschius, observ. 81.

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[u] Mém. de Berlin. 1785, Tab. iii, fig. i. Ce cas merite attention uniquement à cause de son extreme rareté. Malacarne Osserv. di Chirurgia, part. ii, pag. 119, fig. iii.

If I wished to proceed farther in the enumeration of the different places in which aneurisms are formed by the rupture of arteries of the second and third order, I might include in the class of these diseases those extravasations of arterial blood which occur within the head from the rupture of the *meningeal* artery, in which the blood effused between the dura mater and the cranium presses the dura mater inwards in the manner of a tumour, compressing the brain, as the aneurism happening from the rupture of the internal mammary, or any of the intercostal arteries, does with respect to the heart or lungs. I might then come to the aneurisms of the cœliac, splenic, hepatic, mesenteric, and renal arteries, of which I would have several examples to relate, if I did not consider it at present more proper, after all that has been said of the *internal* aneurisms, as well as of the *external* which occupy the arteries of the second order, to confine myself to the consideration of those which affect the *smaller* external arteries.

§ 17. Therefore, with regard to the aneurisms of the external arteries of the body of a smaller size, th rupture of the temporal artery, in consequence of a blow, is not at all a rare case, the integuments covering it remaining uninjured, under which the effused blood collecting itself forms a *circumscribed* swelling with pulsation, and all the characters which were said to be proper to the *true* aneurism.[x] Palletta mentions,[y] that 'a corpulent man, of ordinary height, in beating his head against a wall, caused such a contusion of the right temple, that, in addition to the ecchymosis, there *arose* a *small tumour* of the canal of the temporal artery, which burst sixteen days after, and, in consequence of the great loss of blood, obliged the patient to come to the hospital, where the hemorrhage was stopped by compression. In the course of thirteen days the dressings were found to be covered with pus; the healthy wound, as large as a crown-piece, healed in twenty-six days, without any remains of morbid pulsation.' I have twice had occasion to observe and cure the aneurism of the temporal artery proceeding from a violent contusion of the temple. The *circumscribed* and *pulsating* tumour had so much the characters of a *true* aneurism, that it might easily have misled any one who was not previously informed of the contrary. On opening the tumour, I found the artery ruptured, and I accomplished the cure by means of compression.[z] A similar

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[x] Bartolino epist. med. 55, Centur. iii. Cavallini Collez. istor. t. ii.

[y] Giornale di Venezia loc. cit.

[z] In the Salzburg. Zeitung for October 1805, the following case of aneurism of the occipital artery is related. The patient, when about 19 years old, had received a blow on the nape of the neck; soon after, a small swelling about the size of a nut gradually formed. It bled repeatedly, and during ten years various remedies were employed without effect. At last the artery was se-

circumscribed pulsating tumour was observed upon the auricular artery, behind the helix of the left ear, in a young man 25 years of age,[y] in consequence of having received a wound at that place. Of the same nature, or from a rupture or laceration of the artery, was the aneurism of the external artery of the nose, mentioned by De Haen;[z] that of the intercostal artery and of the heel, spoken of by Ruisch;[a] that of the frontal artery, the history of which may be read in the Acts of Leipsig;[b] and that of the hand related by Becket.[c] Guattani[d] relates the case of an aneurism of the palm of the hand, in the site of the palmar arch; and whilst he shews himself to be persuaded that it was a *true* aneurism, he declares, that, on opening the tumour, he found the artery opened, not dilat-

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cured by a ligature above and below the aneurism, and the patient, in the course of a month, was completely cured. See Ludov. Meyer, Dissert. Inaug. de Aneurysmate arteriæ occipitalis, 1804. *T.*

[y] Klaunig. Ephemerid. nat. cur. cent. iii, obs. 66, an. 1715. Erat is juvenis an. 25 cui post auris sinistræ helicem ramus posterior arteriæ carotidis gladio transcindebatur. Suppressa hæmorrhagia aneurysma a loco transcissæ arteriæ ad lobum auris usque se extendens, crassitiem duorum pollicum adæquans, et tam vehementi pulsu præditum, ut aurem hinc inde commoverit. Compressio nullam attulit utilitatem. Interim tumor gangrenam minabatur, et rupturam a parte conchæ auris; deinceps per duo ostia sanguis arteriosus uno impetu tanta vi prorumpebat, ut duo chirurgorum manus hæc ostia comprimentes vix sufficerent ad inhibendum. Detecto tumoris fundo hianti arteriæ injecta fuere aliquot frustra aluminis crudi, et adhibitis stipticis pluribus plumaceolis omnia optime firmabantur. Cum sequenti die hæmorrhagia recurreret, arteriæ iterum aluminis frustula et lintea carpta profunde intrudebantur. Suppuratio inde, &c. &c.

[z] Rat. medendi, part iv, pag. 11.

[a] Thesaur. Anat. ix. N. V. Obs. Anat. Chirurg. 38.

[b] An. 1699, pag. 51.

[c] Chirurgical Observations.

[d] De extern. Aneurysm. Hist. xxi.

ed. Hildanus[e] and Tulpius[f] mention aneurisms observed by them between the thumb and fore-finger, of the nature of which there can be no doubt, the patient having, some time before the appearance of the tumour, pricked himself at that part. Guattani likewise[g] relates the history of a small pulsating aneurism on the tarsus, which had the principal characters of a *true* aneurism; and he remarks, that although there are only small branches of the anterior tibial artery on the dorsum of the foot, nevertheless, some of these branches being injured, may be elevated into an aneurism. But since it appears from the history, that this pulsating tumour on the tarsus had appeared after a bleeding performed there, it may be safely inferred that the aneurism was not formed by the dilatation of the proper coats of the artery, but by a solution of continuity or wound of them, and effusion of blood into the surrounding cellular substance, as happens, in short, in the formation of aneurisms in general, either of the aorta, or of arteries of the second or third order.

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[e] Centur. iii, obs. 44.

[f] Oper. med. lib. iv, observ. xvii.

[g] Loc. cit. Hist. xii.——quod, licet in pedis dorso non nisi tenuissimæ tibialis arteriæ anterioris propagines disseminentur fieri tamen possit, ut læsæ in aneurysma etiam ipsæ assurgant.

Richter, in the 4th vol. of his *Chirurg. Bibliothek*, mentions a case of rupture of the left pharyngeal artery in a girl about seven years old, occasioned by a violent exertion on being pulled forcibly to the ground backwards. The girl was immediately seized with headach, pain under the left ear, and an uncommon drowsiness. In eight days after the accident a swelling appeared on the left side of the throat, extending up as far as the mastoid process, and downwards to the clavicle. As a fluctuation was perceived in it, an opening was made, by which a quantity of bloody serum was discharged, and the child soon after died. The tumour was found to contain coagulated blood, which had insinuated itself into the interstices of the contiguous muscles.—*T.*

CHAPTER VIII.

OF THE CURE OF ANEURISM IN GENERAL.

§ 1. It is a certain and incontrovertible fact in practical surgery, that a complete and truly *radical* cure of aneurism cannot be obtained, in whatever part of the body this tumour is situated, unless the ulcerated, lacerated, or wounded artery, from which the aneurism is derived, is, by the assistance of nature, or of nature combined with art, obliterated and converted into a perfectly solid ligamentous substance, for a certain space above and below the place of the ulceration, laceration, or wound. This fact, proved by a long series of observations, authorizes us, with regard to the radical cure of this disease, to conclude, that all those deviate far from the truth, who think, when the radical cure of an aneurism is obtained by means of compression, that it is effected by the pressure strengthening the dilated proper coats of the artery, and restoring, especially to the muscular coat, the power of propelling the blood along the tube of the artery, as it did previous to its supposed *dilatation*. M. Petit and Foubert did not adopt this opinion, but thought, that the curative process which nature sometimes employs for curing this disease, consists in a species of clot formed by the *fibrine* of the blood, by means of which it closes the laceration, ulceration, or wound of the artery, and that this clot firmly agglutinated to the edges of the laceration, or to the lips of the wound, resists sufficiently the impulse of the arterial blood, to preserve the continuity of the coats of the injured artery, and to maintain the tube of the artery in a pervious state. Haller was of this opinion, and mentions, that he had seen this kind of curative process of aneurism, occasioned by the puncture of an artery, begin before his eyes in the mesentery of a frog. For, he says, that he had observed, that there is formed all round the incision of the artery a kind of speck or cloud, which, from being quite red at first, becomes afterwards pale at the edges. In the middle of this cloud, continues he, a clot is found, formed by the reunion of the globules of the blood, the motion of which is moderated a little opposite to the seat of the clot, and then it resumes its course. There can be no doubt, Haller adds, that it is a coagulated fluid which closes the lips of the wound of the artery. I have seen, he proceeds to state, red globules pass from the artery, by two or three channels, through the cloud, and ooze out between the layers of the mesentery. The hemorrhage re-appears every time the artery is scratched, and the gluten removed which had closed the wound of it. I have opened, continues Haller, an aneurism of this kind in a frog, from which no blood has issued, and I have found that it was formed by a membrane which surrounded it circularly, having a small fissure closed by a clot of blood. I have observed on other occasions, that this blind membranous sac was gradually filled with blood, which was conveyed to it from the heart, and that when the sac was filled, the blood passed onwards, and took the route of a neighbouring lateral branch.[a]

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[a] Mémoire I. sur la circulation du sang, pag. 116. Il se forme autour de l'incision une espece de petite tache comme une nuage, qui d'abord est toute rouge, elle change ensuite et palit dans les bords.

§ 2. Whoever has accurate and extensive practical knowledge on this subject, cannot deny that this beneficent process of nature sometimes takes place, especially in the case of aneurism in the bend of the arm from the puncture of a lancet. I shall relate a very marked example of it,[b] where the bloody thrombus had not only closed the wound of the brachial artery made by the lancet, but in which the apex of the thrombus interposed between the lips of the wound was likewise converted into a hard substance, and adhered so firmly to the artery externally, that on viewing the artery on the inside, it was covered at the place of the wound by a solid cicatrix, or by something similar to a cicatrix. But this case of conversion of the clot into a substance resembling the internal coat of the artery, or, if any one chooses rather to say, this cicatrix of the wound of the artery, is a very rare occurrence, and so rare indeed, that I do not know if there is another perfectly similar recorded in the books of surgery. More commonly, when the circumstances are sufficiently favourable for nature repairing the injury of the artery by means of the throm-

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bords. Au milieu ou trouve le caillot formé par la reunion des quelques globules; le mouvement du sang se ralentit peu à peu dans l'artere même jusqu'à ce que ce fluide ayant passé au dela du caillot, reprenne sa premiere route. Il est bien sûr, que c'est une liqueur coagulée qui forme la playe de l'artere. J'ai vû des globules rouges se frayer à travers ce brouillard deux, ou trois routes pour se jetter par la playe entre les lames du mesentere. Et l'emorrhagie reparoit egalement, quand on ratisse l'artere, et qu'on ôte le gluten qui en ferme la playe. J'ai coupé un aneurisme de cette espece, il n'en coula rien, et j'ai trouvé une membrane, qui l'environnoit circulairement, avec une petite fente bouchée par un petit caillot. Je vis ce sac borgne se remplir peu à peu de sang qui lui venoit de la colonne du coeur, comme la plus forte; quand il fût rempli, le sang passa outre, et se jetta dans un rameau voisin.

[b] Chap. xi, § 9.

bus, or clot of coagulated blood, the adhesion of the thrombus to the lips of the wound is so weak and imperfect, that it cannot be regarded as a *radical* cure. For, when some time has elapsed after the supposed cure, sometimes even years, on the occasion of a blow or exertion, the thrombus is removed from the wound of the artery, and the aneurism re-appears as before. The first case cannot, strictly speaking, be reckoned among the number of the radical cures. For, whether the clot is converted into a substance resembling a cicatrix, or if a cicatrix is really formed at the place of the wound of the artery, as in other simple wounds, as the portion of the coats of the artery occupied by the cicatrix assumes a certain degree of cartilaginous or bony rigidity, (as was the case in the patient I examined, in which respect it differs greatly from the natural flexibility of the proper coats of the artery;) so this portion of artery occupied by the cicatrix is always found in a state ready to burst and break, if the arm is by any accident violently stretched or struck at the place where the artery has been wounded. On which account, I repeat it again, the cure cannot, in similar cases, be with justice regarded as *radical*.

§ 3. The obliteration, therefore, of the artery, and the conversion of it into an impervious and ligamentous substance, for some space above and below the injury, is the only means of producing a truly and permanently *radical* cure of aneurism. Whenever the ulcerated, lacerated, or wounded artery is accurately compressed against a hard body, such as the bones, it ceases to pour blood into the surrounding cellular sheath, because its sides are kept in firm contact, for a certain space above and below the laceration or wound; and because, being irritated by the hard, oblong knot, without any pulsation. This patient having died of a stroke of apoplexy, his body was examined, and the right carotid artery was found to have been completely closed up, and obliterated from the place of its bifurcation, as far as the subclavian artery of the right side. M. Desault[l] had an opportunity of examining a popliteal aneurism in the body of a patient in whom the spontaneous cure was just beginning. He found a very hard bloody thrombus, which extended for three fingers-breadth within the tube of the popliteal artery, above the aneurismal sac. This thrombus was so hard, that it had been able to resist the force of the injection thrown in by the corresponding iliac artery, and had obliged the injection to pass to the subjacent leg and foot, by the lateral vessels. And, since it is a certain and demonstrated fact, that, even after the *spontaneous radical* cure has been completed, the artery is found perfectly closed up, and converted into ligament, it is proper to mention, that this spontaneous cure, as well as the artificial, has two stages; in the first, the entrance of the blood into the aneurismal sac is interrupted; in the second, by the powers of nature, the parietes of the artery are made to approach to each other, and are afterwards firmly agglutinated together, and converted into a solid cylinder. This theory is supported by the tumour, in the artificial as well as in the spontaneous *radical* cure of aneurism, beginning to loose its pulsation, and then diminishing and disappearing. The objection therefore was just, and conformable to the truth of the fact, which Morand[m] made to the theory of Petit, in relation to the bloody thrombus, which the latter regarded as the principal means which nature employs for stopping hemorrhage. Morand shewed, that the thrombus stops the course of the blood only for a short time, but that which properly prevents the return of the hemorrhage is the contraction of the artery upon itself, the disappearance of the thrombus, the obliteration of the tube, and the cicatrisation of the divided artery.[a] The ar-

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[l] Journal de Méd. de Paris, t. 71, p. 430.

[m] Mém. de l'Acad. des Sciences de Paris, an. 1736.

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[a] With regard to the suppression of hemorrhage, it appears to me that the author, and all the writers mentioned by him, have erred in the account which they have given of this important phenomenon, from having attended exclusively to one stage of this process only, while they entirely overlooked, or very much undervalued, the other steps of it. So far as their observations went, they were accurate, and conformable to the truth; but, from being confined to one stage of the process, they were inadequate to the explanation of the series of changes on which the suppression of hemorrhage from divided or wounded arteries is now found to depend. From the experiments performed, in conjunction with Dr. Thomson of Edinburgh, by Dr. Jones, as related in Dr. Jones' Treatise on hemorrhage, &c. we are now authorized to conclude, that a variety of circumstances concur in the natural suppression of hemorrhage. The chief of these is the retraction and contraction of the divided artery; the weakening of the impetus of the blood, after the first sudden effusion of it is diminished; the effusion of blood into the cellular substance, and into the sheath of the artery; the formation of a coagulum which finally closes up the mouth of the artery, thus forming the primary complete obstruction to the further discharge of blood. A clot is also formed within the artery; but as this is uncertain, and as it seldom fills the canal of the vessel, or if it does fill it, as it does not adhere to its internal coat, its formation is to be considered as merely accidental, and appears to depend on the stoppage of the circulation between the first collateral branch and the mouth of the artery, after it has been closed by the external coagulum. Soon after the formation of these coagula, an effusion of lymph takes place within the artery, which adheres firmly to its internal coat; and, as the contraction of the vessel gradually proceeds, an approximation and firm union of the sides of the artery are produced, the canal of the artery is obliterated, and at last converted into a ligamentous substance. *T.*

teries have naturally a great tendency to contract a
obliterate, and are in fact closed up and obliterat
readily whenever the blood ceases to flow throu
them. Haller saw this power of contraction of t
arteries in the mesentery of frogs, although he
serts, that the arteries of this animal have no mu
cular coat.[m] Kirkland,[n] in the numerous expe
ments which he made on animals, found that t
arteries, when strongly compressed or tied, were
a day or two after closed and obliterated for a c
tain space below the compression or ligature; a
in a case of aneurism in the bend of the arm, opera
ed upon by the ligature of the artery, he found in t
body, after death, that the brachial artery had be
converted into a solid cylinder only three days aft
the operation. It is not improbable, that, in the cas
of spontaneous *radical* cure of external aneurism
(which are indeed very rare) there concurs also a pa
ticular position[o] of the aneurismal sac; by means
which, this sac being compressed by the ligamen
and tendons, makes such a fold as to compress wi
an equable force, as in the artificial compression, t
trunk of the injured artery, at its entrance into t
sac, and is therefore capable of producing the a
proximation of its sides; and at last, on the *ad*

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[m] Mémoire i, sur la circulation du sang, p. 117. Il y a enc
une autre façon, dont les playes des artéres se ferment, c'est
la contraction de leur membrane: non qu'elle soit musculeuse,
il n'y en a point de paraille dans les artéres des grenouilles, par u
attraction naturelle qui rapproche les fibres, vers l'axe, qui les r
mene du contact du reste de la membrane, et qui a lieu même da
les artéres du cadavre.

[n] On Amputation.

[o] Dr. Thomson of Edinburgh has for several years expressed
similar opinion, and has been in the use of illustrating it with fi
gures, in his lectures on surgery. *T.*

sive inflammation coming on, the tube of the artery is also obliterated, which constitutes the second stage of the *radical* cure of this disease.

§ 4. This union of the internal sides along with the obliteration of the tube of a large artery, sometimes happens also in consequence of a violent contusion of the artery, especially if immediately, or a little after the accident, the course of the blood within the contused artery is artificially interrupted. On this subject Morand relates the following fact.*

In the month of December 1735, a countryman received a violent contusion on the inner side and middle of the humerus, along the course of the brachial artery. The external veins were ruptured, and the loss of blood arising from them was stopped by the surgeon, by the ordinary means. The hemorrhagy having recurred, in spite of a very tight bandage, the surgeon applied a tourniquet above the place of the injury, and supposing that the loss of blood proceeded from the trunk of the brachial artery, he was of opinion that amputation ought to be performed. Two days had elapsed from the time of the accident, when Morand was called in; he found an eschar on the injured place, which appeared to him only to affect the integuments. The fore-arm and hand, which were of their natural colour, and not much swelled, retained their natural heat and life, but the pulse was totally wanting. Morand supposed that this want of the pulse was owing to the tourniquet being too tight. On loosening the tourniquet, not a drop of blood was discharged. The brachial artery pulsated above the place of the contusion, as far as the seat of the eschar, but could not be felt beating under the eschar, and still less at the wrist. Notwithstanding the want of the pulse, as the fore-arm and hand preserved their natural colour and heat, amputation was not had recourse to. Having placed the arm in a position favourable to the course of the blood, and applied proper topical remedies, the ecchymosis and swelling abated, and on the eleventh day the suppuration began to detach the cutaneous eschar. The pulse however did not return, and the arm continued in a state of numbness, and began to decay, and the patient complained of a severe pricking sensation within it. In the course of six weeks the pulse was not at all sensible; it then re-appeared gradually, but remained afterwards weak, although the patient had recovered the use of the injured arm.

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* Mém. de l'Acad. R. de Paris, an. 1736.

This singular case, says Morand, presents to us very important conclusions. It is probable, says he, that the stopping of the pulse ought to be ascribed to a change having taken place in the trunk of the brachial artery, corresponding to the place of the contusion. And what can this change be, he adds, except an approximation and contraction of the sides of the artery; in consequence of which, the internal parietes have contracted an adhesion to each other. And it is a thing worthy of remark, that this adhesion of the internal parietes of the artery, in the direction of its axis, took place quickly. If the limb continued to live, and if the pulse re-appeared, it was owing to the circulation having been re-established gradually, by means of the collateral vessels.

§ *5.* In those cases in which the aneurism is affected deeply by gangrene, it is not difficult to comprehend how the injured artery is closed immediately above the aneurismal sac, and how consequently the gangrene produces the same effect as the compression, or the ligature of the artery. For, on the appearance of the gangrene, the whole part that surrounds the root of the aneurism is affected by violent inflammation, by which the coats of all the vessels of the part are thickened, their opposite sides made to approach each other, and become so firmly agglutinated together as to be closed up; or a dense, compact, bloody coagulum is formed within them, which shuts up the canal of the vessels, and interrupts completely the course of the blood within them. The obstruction of all the vessels of a part affected by gangrene, not only in the place occupied by the mortification, but likewise at some small distance above it, is a constant fact, proved by repeated observations. If, in a patient attacked by gangrene of the lower part of the leg, the vena saphena be divided longitudinally at the usual place of bleeding, the blood within the vein is found to be coagulated, and adhering to its sides, and not a drop of fluid blood issues from the incision, although the person survive for some time, and the vein remain open.[a] The injection of the dead bodies of patients, who have died in similar circumstances, shews that the canal of the arteries is closed and obstructed at the edges of the gangrene; which arteries, as well as the veins, are pervious and open, as in the sound state, immediately above the limits of the mortification. Whenever, therefore, gangrene attacks deeply the root of an aneurism, the sphacelation which follows it, and the bursting of the integuments, and of the aneurismal sac, are never accompanied by a fatal hemorrhage; because this gangrenous process has closed up not only the small, but also the great arterial trunks, above the place of the injury, and the patient is cured of the gangrene and of the aneurism, if he has strength sufficient to resist the destructive action of the sphacelus upon the vitality in general. When a patient dies of hemorrhage from a gangrene, or sphacelus of an aneurism, he dies, because the gangrene or sphacelus have only occupied the integuments and a portion of the sac, and have left untouched the rest of the root of the aneurism, especially the arterial trunk, from the laceration or wound of which the aneurism is formed.

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[a] Maunoir Mém. Physiolog. et. Prat. sur l'Aneurisme, p. 129.

§ 6. M. Deschamps says,* that every surgeon has a particular opinion of his own, with regard to the manner in which the cavity of an artery is obliterated; but that every surgeon, if he is a man of integrity, will agree, that we have not as yet any positive and well determined practical knowledge on this subject. I on the contrary find, that with regard to this point, there can be but one opinion, and I think, that this opinion is firmly supported by practical observations, and by certain and constant facts, and that it is proved by daily experience in that part of surgery which relates to the cure of wounds by the first intention. There is nothing more manifest, and better known in surgery, than that the *adhesive* inflammation is the principal means by which the parts divided in the living solid, as well as those organically separated, when kept in mutual contact, contract a firm adhesion to each other. The *adhesive* inflammation is that power to which we are indebted for the re-union of simple wounds, and for the coalescence of some parts together, often to the great advantage of the whole animal economy; provided this kind of inflammation does not exceed certain limits, beyond which it changes into *suppurative*, or destructive inflammation, or as is commonly said, occasions an abscess. It is, for example, by means of the *adhesive* inflammation, that the smooth surface of the lungs adheres to the pleura in the violent peripneumony, and in penetrating wounds of the thorax, with injury of the lungs themselves; that the intestine contracts an adhesion with the mouth of the hernial sac in the incarcerated, and inflamed hernia; that the wounded, inflamed intestine, when replaced in the abdomen, adheres to the peritoneum; that the vaginal coat of the testicle unites firmly to the albuginea in the radical cure of hydrocele; that sinuous ulcers, made to inflame artificially, and then compressed, are cured by the first intention. And not to wander from the consideration of the blood vessels, it is the *adhesive* inflammation which sometimes after venesection, causes the obliteration of the divided vein for a certain space, and if this inflammation passes beyond certain limits at the place of the bleeding, and is changed into the *suppurative*, it occasions a small abcess where the vein was opened, which is ascribed by ill-informed surgeons improperly to some defect of the lancet, or to the puncture of some nervous or tendinous filament.[p] It is this process of *adhesive* inflammation which nature, by itself alone, or assisted by art, employs for agglutinating, and uniting firmly together, the two opposite parietes of an artery, whenever the internal surface of these parietes is placed, and kept in firm contact by means of some accidental pressure, or by a methodical bandaging; and there is no essential difference in the process of adhesion between the lips of a simple wound, or between the surface of an intestine with the peritoneum, or of the vaginal coat of the testicle with the albuginea, and the manner of union of one side of an artery with its other side. I have more than once seen the commencement of this process of obliteration of the cavity of an inflamed artery, in the bodies of those who have died soon after amputation, in the inflammatory state of the stump; and not long ago, I met with the same phenomenon in a certain portion of the femoral artery, which a week before had been injured by a musket ball. That is, I found, that the proper coats of the artery at that place were become thicker than usual, and that the internal coat was of a deep red colour, and covered with an exudation of coagulable lymph, on removing which mucous exudation, the internal surface of the artery appeared to be converted into a pulpy, villous substance, very vascular, and much disposed to contract an adhesion with its opposite side, if by means of a methodical compression both of the parietes of the inflamed artery had been approximated, and kept in firm contact with each other, as is practised in the cure of simple wounds, by the first intention.

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* Oberv. et reflex. sur la ligature des artéres, pag. 52. Chacu ce fait un opinion particulière sur la manière d'effacer la cavité d' artére; mais si l'on est de bonne foi, on conviendra, que no n'avons encore à ce sujet aucune connaissance pratique bien d terminée.

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[p] The great veins also are sometimes closed, and obliterated spontaneously. See Morgagni de sed. et caus. morb. epist. lvi, art. 10. Haller. opusc. patholog. ob. xxiv. Vena cava inter renales venas, et iliacas concreta fuit, ut nihil cavitatis loco superesset nisi fibrosa quædam, quasi carnea, pulposa et dura caro. Concretæ venæ rationem,

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tionem, fateor, me non intelligere, cum in eo cadavere nulla causa, tanta venam comprimere apta, neque ullum in arteriis vitium repertum fuit. See also Maunoir loc. cit. p. 15.

§ 7. In order that the compression may produce the union of the two opposite sides of an artery with each other, and at the same time the *radical* cure of the aneurism, it is therefore necessary, that, besides the state of vitality of the coats of the artery, of which I shall speak afterwards, the degree of pressure applied upon the artery, be such as to place the two opposite parietes of the injured artery in firm and complete contact, and that it be at the same time capable of exciting the *adhesive* inflammation in the proper coats of the artery Without the concurrence of these circumstances, the compression does not prove beneficial, or only produces an incomplete cure; for, whenever the compression is not sufficient to place the two opposite sides of the artery in complete and firm contact, and does not excite in them the *adhesive* inflammation, including also the root, properly speaking of the aneurism; and when the inflammation affects only the cellular substance surrounding the artery, and the parts contiguous to it, this cellular substance, and these parts only contract an adhesion with each other, and are converted into a hard, compact substance, while the canal of the lacerated or wounded artery remains open and pervious as before the use of compression. It therefore follows from this, that if, from any accident, the cohesion of the cellular sheath of the artery, with the neighbouring parts, is afterwards weakened, and the coagulated clot removed from its situation, which kept the thick and compact cellular substance closed after the manner of a small coriaceous capsule applied forcibly to the laceration, or wound of the artery, the arterial blood is again effused, and causes the aneurism to re-appear. It is further necessary, that the point of the compression fall above the laceration, or wound of the artery. For, if the compression falls below the injury, instead of being a method of cure of the aneurism, it rather occasions the tumour to augment to a much greater size, and to increase in a shorter time, than it would have done if the compression had not been employed at all; as, it is a well known fact, that compression applied to an artery below the place of the wound, accelerates greatly the afflux to the wound, and the effusion of blood through it. Instruments have been invented resembling a tourniquet, by means of which, it was intended to compress the artery with precision, at the place which the surgeon should find most convenient for this purpose, and without retarding the return of the venous blood; the shape of which instruments has been delineated by almost all the authors of systems of surgery. But in this, as in many other circumstances, experience has shewn, that not unfrequently those discoveries which in theory seem to be the most convenient and useful, are not so in practice; and experience has taught us, precisely in the case of which we are speaking, and especially in a case of aneurism in the ham and in the bend of the arm, that the bandage which is at the same time, *expulsive* and *compressive*, is greatly to be preferred, when necessary, to the above-mentioned instruments.

§ 8. Among the number of favourable circumstances, which are necessary, in order that the compression prove an effectual mode for accomplishing the radical cure of aneurism, I have mentioned, that it is necessary, that the coats of the artery possess, at the place of the compression, such a degree of vitality, as to be capable of feeling the stimulus, to use the expression, and of inflaming. This important requisite is sometimes wanting in that portion of ruptured, or lacerated artery, which is contiguous to the place of the injury, and therefore in such a case, *cæteris paribus*, the compression, although practised with the rules of art, is not sufficient to close and obliterate the artery above the root of the aneurism. I have already shewn, that in spontaneous aneurisms, or those from a slow internal morbid cause, from original or acquired diathesis, or from excessive local relaxation, the proper coats of the artery round the edge of the rupture, ulceration, or laceration, are in a state of disorganization, deprived of vitality, and consequently no longer susceptible of *adhesive* inflammation, nor of undergoing any process of union or coalescence. When, for example, the aneurism has had as a proximate cause, a *steatomatous* degeneration of the proper coats of the artery; when it has been preceded by a slow ulceration of the internal coat of the artery; when it has originated from a state of excessive *relaxation*, or of *earthy* hardness, with *brittleness* of the arterial coats, there can be no doubt that the portion of artery all round the root of the aneurism, or that which surrounds the edge of the rupture or laceration, at a greater or less distance above the place of the injury, will never be affected by *adhesive* inflammation, although compressed with accuracy, and with the most precise rules of art, so as to bring the two opposite sides of the artery into complete and firm contact; and the parietes of the artery at that place will never form a firm cohesion with each other, so as to be capable of obliterating the tube of the artery, and converting it into a perfectly solid cylinder. This difficulty, suggested by reasoning, by analogy, and by an accurate knowledge of the nature of this disease, in cases of spontaneous aneurism, is brought to demonstration, and clearly proved. For, in the bodies of those who have died some time after the ligature of the femora artery on account of an aneurism, in which the cohesion had not taken place at the part where the ligature was applied, on account of the morbid state of the proper coats of the artery at that place, it has been found,[q] that the internal coat of the artery above, and below the seat of the ligature was disposed to thicken and inflame; but that, at the place of the ligature, the proper coats of the artery, and especially the internal coat were always of a whitish colour, and not at all disposed to feel the stimulus of the pressure, or of the cause intended to produce the inflammation, as those parts generally are which have become inert and deprived of their vitality. The learned and experienced surgeon Vacca,[r] operated upon a popliteal aneurism according to Mr. Hunter's method, in an old and sickly patient. The femoral artery remained tied in this patient for 25 days, without discharging a drop of blood; but after this time, repeated hemorrhages occurred. On examining the body afte death, Vacca found, that in spite of so long a contact, a coalescence had not taken place between th parietes of the artery, and a clot had not been formed sufficiently firm to stop up entirely its tube. On opening the femoral artery in its whole length, he observed, that the internal membrane of this artery was very much thickened, everywhere indurated, and in several points cartilaginous; that at the place of the ligature, the wrinkled parietes of the artery approached each other, but left a small hole in the middle above a line in circumference, the sides of which were not united, and through which a little injection had escaped, and had forced out a clot of a conical figure six lines in length, with its base towards the wound, and the apex towards the heart.

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[q] Transactions of a society for the improvement, &c. vol. ii, p. 255.

[r] Istoria d'un aneurisma del poplite operata col metodo d'Hunter.

§ 9. There are some surgeons who have adopted the maxim of employing compression in every case of aneurism, whether the aneurism be small, *circumscribed*, soft, flexible, indolent, or form an elevated, *diffuse*, hard, and painful tumour. In the latter case, experience however shews, that compression, besides being useless, is hurtful; because it occasions an increase of the swelling in the part subjected to the pressure, makes the tumour compressed on one side to augment greatly on the other, and very often accelerates the appearance of gangrene. Others, especially those who adhere firmly to the common doctrine of aneurism distinguished into *true* or from dilatation, and into *false* or from effusion, are of opinion, that only in the case of aneurism from *effusion*, every kind of bandage ought to be laid aside, as adapted rather to make the aneurismal tumour increase, than to procure the diminution of it. But since it is now demonstrated, that this distinction of aneurism into *true* and *false* does not exist; that all aneurisms are formed by effusion; and that there are numerous and well authenticated histories of *radical* cures of aneurism by means of the bandage and of compression; so the doctrine of these authors, with regard to the propriety or impropriety of compression, requires to be explained with more perspicuity than they have done, in order that it may not cause confusion and perplexity in the mind of the young student. A bandage, of whatever kind it be, which, compresses the aneurism, and constricts at the same time circularly the affected part, is always injurious, and ought undoubtedly to be left off. The bandage likewise, which compressing only the aneurism, directs the point o pressure below the place of the injury in the artery; tha which, on account of the great size, and exquisite sensibility of the aneurism, the depth of its root, and the fleshiness of the parts which surround the tumour, is not sufficient to compress the artery against the bones, so as to bring the two opposite sides of the artery into mutual and firm contact; and lastly, the compression that is applied upon a spontaneous aneurism, the origin and progress of which shew, that it has arisen after a *steatomatous*, *ulcerated*, *earthy* degeneration of some portion of the coats of the injured artery, ought to be considered as an useless, or rather hurtful method, and as these writers have mentioned, ought to be entirely laid aside. In cases completely opposite to those just pointed out, it is equally certain, that the bandaging has produced, and may produce *radical* and complete cures of aneurism, and that, consequently i is not a method to be entirely excluded from surgery

§ 10. The compression would certainly be a less fallacious method for the *radical* cure of aneurism, if we could, in every case, apply the pressure to the injured artery, denuded, and without the interposition of the parts that surround and cover it. For, in similar circumstances, we might ascertain the sound place of the artery above its laceration, and we might be enabled to calculate with sufficient precision, the force which it would be proper to employ, in order to bring the two opposite sides of the artery, which we wish to obliterate, into firm contact with each other; and further, because the piece of sponge, and compresses which are placed over the artery, might be moistened with some astringent proper for causing a contraction of the artery, and for exciting the *adhesive* inflammation in its compressed coats. This manner of applying the compression proves in fact very useful and efficacious, for the *radical* cure of the aneurisms of the arteries of the third order, which lie close upon the bones, or in the vicinity of them, when denuded by means of the incision of the aneurismal sac; as is practised in aneurisms of the temporal and occipital arteries, of those of the face, of the radial artery, of that of the tarsus and the like. Examples likewise are not wanting of the success of the compression upon some of the great arteries of the limbs when denuded, such as the brachial,[s] and the femoral,[t] both in the middle of the thigh, and even at the crural arch.[u] But after having duly considered the subject, if the surgeon hesitates to lay bare one of the large arteries of the second order, he possesses a method much more expeditious in its execution, and more certain in its event, than that of the compression, I mean the ligature of the artery. For this reason, in similar cases, surgeons, rather than lay bare the great arteries affected with aneurism, give the preference very justly to the ligature.

§ 11. By the ligature of the great arteries as a radical method of cure of aneurism, I do not mean a noose, with which the artery is constricted circularly, but I wish to be understood to speak of a pressure

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[s] Emrich dissert. inaug. de stupendo aneurysmate brachii. Trew aneurysmatis spurii historia, et curatio. Flajani Collezione d'osservazioni, tom. ii, osserv. vi, pag. 19. Garneri, see Bertrandi Trat. delle operazioni, tom. iii, annotazioni, p. 207.

[t] Heister dissert. chirurg. de art. cruralis vulnere periculosissimo feliciter sanato.

[u] Guattani de extern. aneurysm. histor. xv.

made by a ligature of convenient breadth upon the
tery, by means of which its two opposite sides
brought into mutual and firm contact, without the no
resting or pressing strongly upon the sides of the
tery, which is flattened, rather than constricted circul
ly.[1] And it is in this manner, that the surgeon avo
the danger of the rupture of the artery, and of a
condary hemorrhage, and that he is assured of
taining the approximation of the two compressed si
of the artery, as if they were two smooth planes pla
one over the other, and that they contract an ad
sion to each other. It is not without reason, t
surgeons, hitherto, with regard to the subsequent cu
have apprehended the danger of secondary hemorrha
which frequently occurs in consequence of the li
ture of the large arteries of the second order, such
those of the extremities. They have expressed mu
surprise, why this severe accident is not equally f
quent after the ligature of the same arteries in ampu
tion, as in consequence of the ligature for the ra
cal cure of aneurism. But it would seem, that th
had not reflected sufficiently, that the circumstanc
though apparently similar, are not in fact in both ca
the same. That the impetus of the blood towards t
stump, is not equal to that sent to a large artery of a li
when tied, which preserves entire all its ramification
that the artery, in this second case, is very seldom ti

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[1] It appears from the opinion which the author expresses in t
paragraph, with regard to the action of the ligature, that he is
acquainted with the fact first pointed out by Desault, and m
particularly by Mr. Thomson of Edinburgh, that its first effect i
cause a division of the internal and muscular coats of the arte
but as the author, in the following chapter, explains more fully
mode of applying the ligature which he recommends, I shall de
offering any remarks on the subject, till we come to that p
of his work. *T.*

by the greater number of surgeons, so completely denuded and separated from the surrounding parts, as after amputation; and that the course of the *adhesive* inflammation in the second case is longer, and less easily moderated than in the first; each of which circumstances shall be treated of severally in the course of this work.

§ 12. It is a very great inconvenience attending the use of the ligature, as well as the application of the compressing bandage, that the ligature is applied to a disorganised portion of artery, not capable of feeling the irritation, and of inflaming, and consequently not susceptible of adhesion. This inconvenience may occur, if the ligature is applied in the vicinity of the injury, or laceration in the artery occasioned by a morbid degeneration of its proper coats, as most commonly happens in the aneurisms from an internal cause, or in the *spontaneous* aneurisms, as they are called. It may, however, be prevented, by leaving the aneurism untouched, and by tying the artery above it, sometimes at a considerable distance from the place of the injury in the artery, if the nature of the parts, the depth in which the ruptured artery lies, and other circumstances require it. For, with regard to the grumous blood which is left in the aneurismal sac, which has not been opened, it is gradually absorbed, either in whole or in part, by the surprising activity of the absorbent lymphatic system. In aneurisms from a wound, we have nothing to dread, as the artery above and below the incision preserves its natural vitality, and disposition to inflame and adhere. Generally in applying the ligature to any of the great arteries of the second order, besides the caution of compressing, rather than constricting the artery circularly, the surgeon will recollect, that he ties and constricts a living part, upon which the more he increases the degree of pressure the more he accelerates the ulceration, and thereby the premature division of it. The degree of constriction ought to be such, as to place the two opposite sides of the artery in firm contact, but still to preserve as much vitality, as to resist the ulceration during all that time which is necessary for the *adhesive* inflammation producing the union of the sides of the artery, and at the same time the obliteration of its canal. After this time has elapsed, the *ulcerative* process detaches the ligature, together with a portion of the tied artery, but not a drop of blood is thereby discharged.

§ 13. It is a thing truly worthy of remark, that the obliteration of the cavity of a tied artery is not properly confined to the place of the ligature, and to that portion to which the *adhesive* inflammation has extended, but even after the inflammation has ceased and the union of the two opposite parietes kept in firm contact has taken place, the obliteration continues successively to go on under the ligature, to extend sometimes a great way, and as far as the seat of a large anastomosis. This, properly speaking, is not a power of which the arteries alone are possessed, but it is common to all the other canals of the animal body, which in the same manner as the arteries, have a natural tendency to contract as soon as the fluid which usually flows in them ceases to pass. When the trunk of an artery is tied a considerable way above the root of an aneurism, the column of blood, which from any of the anastomosing vessels, endeavours to enter into the trunk below the ligature, and to pass from thence into the aneurismal sac, has never force sufficient to distend the sac, and overcome the resistance opposed by the clot contained in it. The blood, therefore, which enters into the trunk below the ligature, and above the root of the aneurism, being at first retarded in its course, and then conveyed into the inferior anastomoses, leaves entirely the principal trunk which continues to contract, and becomes obliterated as far as the root of the aneurism inclusively. The blood, wherever it meets with an obstacle to its passage, avoids it, provided it has a more easy channel for continuing its course, according to the law of the vascular system, which we call *derivation*.[1] We see in fact, in the child soon after birth, that the blood of the pulmonary artery finding a more easy course through the lungs than by the ductus arteriosus, leaves this canal to enter into the lungs; that on tying the umbilical vein, the course of the blood from the vena portæ through the liver being accelerated with a new force, leaves the ductus venosus which used to pour it into the subjacent vena cava; that the blood of the ventral aorta, on the cord being tied, takes no longer the route of the umbilical arteries, but that of the arteries of the inferior extremities. Supported by these facts, it may be established as a theorem in physiology, that whenever the blood meets with a powerful obstruction in its passage to a given place, through an artery, it leaves that artery to enter into another, and the artery which has been abandoned diminishes gradually in diameter, until it is entirely obliterated. Whenever, therefore, the pulsation of the aneurism, after the li-

[1] Haller. Deux Mémoires sur le mouvement du sang, mém. i, pag. 48. Si par exemple on lie les artéres mesenteriques d'une grenouille, qui ne seroient que de vaisseaux cappillaires dans un chien, le sang reste d'abord immobile dans le rameau qu'on a lié sans qu'il se forme aucune enflure ; bientot après il retrograde dans les rameaux voisins, et laisse son vaisseau entierement vuide jusqu' à la ligature, et rempli au dessous par le sang qui y etoit, et dont la ligature a arreté le mouvement.

gature of a large artery of the second order, such as the femoral, continues or re-appears, instead of recurring, as some surgeons have done, for the explanation of this phenomenon, to the lateral vessels anastomosing with the trunk below the ligature, and above of the aneurism, the more simple and true explanation of this phenomenon is, that the arterial trunk has not been tied with sufficient force, to bring the sides of it into complete and firm contact with each other,[*]

§ 14. From this two important practical precepts relative to the *radical* cure of external aneurism, may be deduced; in the first place, that the complete cure of this disease may be obtained by tying the artery in the vicinity of the wound, or laceration in it, as well as by applying the ligature at a considerable distance above the place of the injury; without, at the same time, making an incision into, or opening the aneurismal sac. In the second place, that by not opening the aneurismal sac for the cure of this disease, (having in view the resistance which the clots contained in the tumour oppose to the blood which endeavours to enter the aneurismal sac from above downwards, or from below upwards), the ligature applied above the place of the rupture or wound of the artery only, leaving the tumour untouched, renders it unnecessary for the surgeon to apply a second ligature below the place of the injury. The propriety of the one or the other method of operating is determined by the combination of circumstances, which shall be afterwards explained.

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[*] The recurrence of the pulsation in the aneurismal sac after the artery has been tied, has been observed by Molinelli, and other writers; but the most accurate, and, in my opinion, the most satisfactory explanation of this phenomenon, was first given by Mr. Home, in the case of John Clegg, who had two popliteal aneurisms. On the evening after the performance of the second operation, a slight pulsation was felt in the aneurismal sac. The pulsation increased for two or three days; it then gradually diminished; and in eight days after the operation, it was scarcely perceptible. Mr. Home very judiciously observes, 'the only way in which the 'pulsation could recur in the tumour, after it had been stopped, 'must be by means of anastomosing branches; and if the branch 'which renewed the communication had its origin near the liga- 'ture, it is probable, that in the progress of the cure, the femoral 'artery became obliterated higher up than the origin of this branch 'and shut it up.' *T.*

§ 15. At the beginning of this work, it appears to me that I have reduced, to the most complete demonstration, what Haller has already asserted;[a] that is, that the ligature of the *superficial* femoral artery may be performed with the same confidence of success, as the ligature of the brachial artery; or, in other words, without any fear of destroying the circulation, or depriving the subjacent limb of its vitality. And indeed the numerous and conspicuous anastomoses which are met with all round the knee, correspond exactly with those which are observed round the elbow, and at the bend of the arm. And this, as I have mentioned in another place, is not a peculiarity of the arteries of the extremities; but it is a general rule which nature has followed in the distribution of all the arteries, that the superior trunks communicate with the inferior, by means of the lateral vessels. It is a certain and well known fact, that, after the principal trunk of an artery is tied, the lateral branches of it not only carry on the circulation in the parts below the ligature, but that they likewise do so with greater quickness and activity than they did before, when the course of the blood was unimpeded through the principal trunk. This evidently arises from the increase of pressure which the blood that takes the route of the lateral vessels receives, as well as from the enlargement in diameter which these vessels acquire. It is observed, in fact, after amputation of the thigh, that during the time that the blood flows in a full stream from the *superficial* femoral artery, very little or no blood is poured out by the lateral vessels; while, as soon as the *superficial* femoral artery is tied, the blood issues with impetuosity from the small arteries which run along, within the vasti and cruræus muscles; and on these smaller arteries also being tied, the blood immediately oozes out from the minute arterial vessels of the muscles and cellular membrane. And, further, that on the principal trunk of an artery being tied, the lateral branches of it gradually acquire a diameter much greater than they had before the ligature of the trunk, is a fact proved by many observations. After amputation of the thigh performed on account of an aneurism situated in the ham, the size and position of which could not fail to impede very much the course of the blood through the trunk of the femoral artery, it has been repeatedly remarked, that, although both the trunk and the greater and smaller branches of the femoral artery had been tied with the greatest accuracy, the patients have been in danger of losing their life, on account of repeated copious hemorrhages from the innumerable small lateral vessels, that had become unusually enlarged. In several cases, during the treatment, and especially after the *radical* cure of popliteal aneurism, by means of the ligature of the *superficial* femoral artery in the upper third of the thigh, all the ramifications of the recurrent popliteal arteries have been felt beating strongly around the knee. I observed attentively this phenomenon in a patient whom I cured of an aneurism in the upper part of the thigh, by means of the ligature of the *superficial* femoral artery, in the vicinity of the origin of the *profunda.*[b] Boyer,[c] in the body of a man, who some years before had been operated upon for an aneurism in the ham, but who had afterwards died from a caries of the tibia, found, that the arterial branch which runs through the substance of the sciatic nerve was dilated so much as to be equal in diameter to the radial artery. White,[d] in dissecting the arm of a lady, who fifteen years before had been operated upon for an aneurism in the bend of the arm, found that the trunk of the brachial artery was obliterated, and converted into a completely solid cylinder for the space of three inches below the place of the ligature, and as far as the division of the brachial artery into radial and ulnar, but that the recurrent radial and ulnar arteries had acquired so large a diameter, that, taken together, they exceeded the size of the brachial artery above the place of the ligature. Wilmer mentions, that he had seen an injection of the lower extremity, taken from the dead body of a man, whose history he did not well recollect, in which the femoral artery had been previously obliterated for the space of two or three inches, and in which the collateral arterial branches were observed to be so wonderfully dilated, that it might be safely affirmed that the circulation was carried on in the limb, independent of the principal trunk.[e] As a further proof of this, we know for certain, that in the dead body the injection passes more freely from the one extremity to the other of an aneurismatic, than of a sound limb;[f] and, what is still more wonderful on this point is, that even in limbs affected with aneurism, in which we do not observe any evident increase of the diameter of the lateral vessels, the injection passes from the one extremity to the other with more facility than in sound limbs. On which account, if in aneurismatic limbs the injection of melted glutinous substances passes with so great readiness, we may from thence safely infer, how much more easy the passage of the fluid and vital arterial blood ought to be, impelled with regularity by the force of the heart, accelerated by the pressure towards the lateral vessels, and by the oscillation of the flexible and living vessels themselves. Morgagni[g] considered it as a rare and surprising fact, that in the dead body of a man, whose arm Molinelli preserved by means of the ligature of the brachial artery, no other communication was found between the trunk of the brachial artery and the arteries of the fore-arm, than that carried on by a small and tortuous artery, although the arm of that man had continued to be as well nourished, and as strong as the other, and the radial artery pulsated with equal force, as in the sound arm. And, supposing that the injection of all the anastomotic arteries of the flexure of the arm had been made in the dead body of this man by Molinelli with due care, it would be a very clear proof, that, even in the case where the anastomotic arteries of the bend of the elbow do not dilate, after the ligature of the principal arterial trunk of the limb, these anastomotic arteries, such as they are, are sufficient to carry on the circulation, and preserve the strength of the operated limb. On which subject it is proper here to observe, that, although it be self-evident that the circulation through the collateral vessels ought to be much more easy and quick, the lower down the ligature is applied to the principal trunk, yet experience shews, that this difference is not to be estimated very high, and that a greater latitude may be given to this precept than reasoning alone seems to suggest. For it appears, that in a case of popliteal aneurism, *cæteris paribus*, the success is the same, whether the femoral artery be tied very low down in the vicinity of the knee, or in the upper part of the thigh.

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[a] Icon. Anat. Fascic. v. Quare, cum arteriæ articulares superiores, super articulationem genu ortæ, ad utrumque latus patellæ plerumque magnis ramis descendant, seque immittant in inferiores arterias in tibia sub poplite natis, adparet utique arteriam popliteam fere eadem cum spe inter duos condylos ligari posse, aut exscindi, si aneurysma id requisiverit, et æque bonam spem post eam resectionem de tibia pedeque superesse, ac quidem de brachio optima est, quando arteria brachialis in flexu cubiti ligatur, et in anastomosibus illis fiducia chirurgi ponitur, quas alias dicemus, et quarum præcipuæ sunt inter arteriam profundam humeri atque arteriam perforantem tendineum interseptum brachialium musculorum, et inter arteriam ulnarem atque radialem, et interosseam dorsalem. Speravit has anastomoses communicantes vir Ill. Heisterus de genu morbis, n. 77. Winslovius, ut suo loco exposui, non ignoravit ramos descendentes arteriæ cruralis, atque utriusque tibialis sibi inosculari. Ex eo auctore eam spem repetiit Cl. Guenault, in disp. Parisiis, an. 1742, proposita in hunc sensum. Non ergo in vulnere arteriæ cruralis continuo ab amputatione auspicandum.

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[b] Case v, at the end of this work.

[c] Cailliot Essay sur l'Aneurysme, p. 16.

[d] Cases in Surgery, p. 139, pl. vii, fig. 1 and 2.

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[e] Cases and Remarks in Surgery, p. 173.

[f] John Bell, Discourses on the Nature and Cure of Wounds, p. 46.

[g] Loc. cit. epist. l. art. 8. Nulla inveniri arteria potuit, quæ pro ipsa communicationem inter superiorem ejus truncum, et radialem, ulnaremque arterias servaret præter unam, eamque non solum mire flexuosam, sed tenuem adeo, ut difficillimum sit intellectu,

§ 16. What I have hitherto said with regard to the

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tu, quomodo radialis arteria influente tam pauco sanguine, et per tot flexus traducto æque pulsare ac altero in brachio posset, tum æque esse brachium utrumque et nutritum, et robustum, aut certe ad actiones æque idoneum.

communication and passage of the blood from the one extremity to the other of an aneurismatic limb, ought not, however, to be taken in so general a sense, as to be considered as applicable to all the cases of aneurism, and to every subject. For, this facility of the passage of the blood through the lateral vessels is not the same in subjects of all ages, and in the same subject it is not the same in the inferior, as in the superior extremity. In young subjects, or those who do not exceed forty five years of age, the force with which the blood is impelled, and circulates, as well as the oscillation and vitality of the arteries, is much greater than in old persons. Anatomists know, that to obtain a fine injection, it is necessary, in the first place, to choose the body of a young or middle-aged subject. Beyond the forty-fifth year the arterial system begins to become rather rigid, does not yield to distension, and has a disposition to form here and there scales of ossification, especially in the arteries of the inferior extremities; for, in those of the superior extremities, ossification is very rare, even in persons advanced in life. In the same subject there is always, and at every age, a very great difference between the force and the velocity of the circulation in the parts, according to their greater or less distance from the heart; so that, in a parity of age, and other circumstances relative to aneurism, on the principal arterial trunk of an arm being tied, the hope of success will always be greater, than when the principal artery of a lower extremity is tied. The difference which exists between the vitality and the velocity of the circulation of the superior extremities, in comparison with that of the inferior, is so well marked, that, when all circumstances are equal, we daily see wounds and fractures of the superior extremities heal more quickly than those of the inferior; which circumstance seems to be referable to no other reason, as I have mentioned, than the greater vicinity of the superior extremities to the centre of circulation and life.

§ 17. The greatest of all the obstacles which can oppose the success of the cure of an aneurism, especially that in the ham or in the thigh, arises undoubtedly from the rigidity, atony, or disorganization of the principal anastomoses between the superior and inferior arteries of the ham and of the leg, sometimes depending upon the advanced age of the subject, or on it together with the large size of the inveterate aneurism, which, by the long-continued pressure, has caused a great change in the neighbouring parts. It sometimes also depends upon the *steatomatous*, *ulcerated*, *earthy*, *cartilaginous* disorganization of the proper coats of the artery, which is not confined to the seat of the rupture, but extends a great way above and below the aneurism, and includes at the same time the principal popliteal *recurrent* arteries, and with these the *tibial* arteries, and in some cases small spaces of the whole track of the *superficial* femoral artery. Sometimes the pressure exercised by the large aneurismal sac has extended to the posterior and inferior surface of the thigh-bone, which it has stripped of its periosteum, and rendered carious. In this unfortunate combination of circumstances, the ligature of the principal aneurismatic trunk, although it be applied with the most exact rules of art, and at a considerable distance above the seat of the aneurism, either does not produce the union and obliteration of the aneurismatic arterial trunk, or, if it produces it, does not procure a *radical* cure; the increased force of the pressure made upon the blood in the lateral vessels, both before and after the ligature of the principal trunk, not being sufficient to overcome the resistance opposed to it by th straitened and rigid anastomoses of the ham, and by th narrow passage from these anastomoses into the tibia arteries. The leg, therefore, after, as well as before th operation, is deprived of the quantity of arterial bloo necessary for the preservation of its nourishment an vitality. On which account, we cannot hope for favourable event from the operation of the ligature o the principal artery of the lower extremities in the radical cure of aneurism when the patient is much advanced in life, languid, and sickly; when the interna coat of the artery is rigid, and incapable of union a the place to which the ligature is applied; when th aneurism is of long standing, and of considerable size accompanied with symptoms of caries of the posterior and inferior surface of the thigh-bone, or o some of the heads of the tibia, occasioned by the lon pressure of the aneurismal sac against these bones when the subjacent leg is weak and cold, without an evident pulsation in the artery of the tarsus; or whe it is cold, and at the same time very much swelled heavy, and œdematous. These circumstances contraindicating the operation, deserve the most serious attention. For, a certain disposition which some surgeons have to operate in every person, in all cases and in every circumstance, might make the operatio for aneurism fall into discredit, when performed either according to the old or according to the ne method, if aneurisms of the class that I have jus mentioned, in which the operation is contraindicated, came unfortunately under the treatment of thes surgeons. And they would not fail, perhaps, in order to cover their inconsiderateness, to wish to prove by a series of unfortunate facts, the inefficacy of this operation. Prudent persons, and those instructed in the art, will be on their guard against these assertions, and will consider it as a fact, that on the occurrence of aneurism, except in the cases just mentioned, the principal trunk of the injured artery may be tied with impunity at a considerable distance above the place of the injury, and therefore that the fatal consequences of this operation are for the most part imputable to the complication of the disease, to the impropriety of the operation, or to the inaccurate performance of it.

§ 18. The obliteration, therefore, of the artery for a certain space above and below the ulceration, laceration, or wound of it, forms the primary indication which the surgeon has to accomplish in the *radical* cure of aneurism, whether he thinks proper to employ the compression, or the ligature of the injured artery. All the other means of cure are only secondary and auxiliary. Internal remedies contribute to effect it, in so far as they tend to moderate the impetuosity and excessive determination of the blood towards the place where the artery has been compressed or tied. These remedies are, evacuations of blood in young, very robust, and plethoric patients, low diet, diluent drinks, gentle laxatives and glysters, complete rest of body and mind, and cool air. In weak patients, or those who have become so, not on account of their advanced age, but by the acuteness of the pains, the long want of rest, or previous repeated and large evacuations of blood, if there is reason to believe that the deficiency of the vitality may oppose the supervention of the *adhesive* inflammation, and consequently the union of the two opposite sides of the compressed or tied artery, tonics and cordials ought to be given internally, a moderate diet, administered at short intervals; corroborant and slightly stimulating topical applications are to be used externally. It not unfrequently happens, that after the coming away of the ligature, a secondary abscess is formed in the bottom of the wound, which degenerates into a sinuous ulcer, either because the ligature has been too long of coming away completely, or because the position given to the operated part during the treatment has rendered the complete evacuation of the matter difficult. This accident may be cured by facilitating the discharge of the ligature, which has already become flaccid, after the sides of the tied artery have contracted a firm adhesion to each other, by laying open the sinuous ulcer, or placing the operated part in a more favourable position; and likewise, by employing the expulsive bandage, by destroying the fungous flesh, and by inducing a healthy granulation in the bottom of the wound.

§ 19. Debilitating remedies, abstinence, a milk diet, perfect rest, are almost the only means which art can suggest and employ in cases of internal aneurism, and these only in order to retard the fatal progress of a disease from its nature incurable by the hand of the surgeon. Indeed, how could a remedy be applied to an aneurism of the pulmonary artery, or of the arch of the aorta, the extravasated blood of which, by compressing the lungs, prevents the patient inspiring the quantity of atmospheric air necessary for the production of the animal heat, and for the oxigenation of the blood? How could he be relieved from the painful respiration, from the threatening of suffocation, from the turgescence of the vessels of the face, from the deliquium, from the coldness of the extremities, want of sleep, and hectic fever? In the great difficulty of breathing, with which these unfortunate persons are by degrees affected, the evacuation of blood is of very great use; but as evacuations of blood cannot always be frequently repeated, so in some cases we may with advantage substitute instead of these the immersion of the hands and feet into tepid water, friction of the extremities, iced water given internally, with a small quantity of Hoffman's liquor anodynus mineralis. Some temporary relief in the greatest difficulty of breathing is obtained by sinapisms, either simple, or rendered more active by a small quantity of powdered cantharides, applied to the arms, to the thighs, or feet, by their suspending or removing that state of spasm and constriction with which the viscera of the thorax are affected. In those cases in which the aneurismal sac has corroded the bones, and appears externally, as on the outside of the sternum, ribs, clavicles, or vertebræ, the surgeon ought to abstain from every kind of compression upon the tumour, as the pressure would not cause the aneurism to diminish in the least, and by forcing it inwards, it might occasion it to compress more strongly than before the important viscera which are in contact with it. In the last period of the disease, when the most prominent portion of the sac protruding from the thorax, together with the integuments covering it, passes into gangrene, and the whole is converted into a sphacelated eschar, the little which remains for the surgeon to do, is reduced to the abstaining from the employment of emollient applications, and in using, instead of these, astringents and stimulants, such as vinegar impregnated with sea salt, camphorated spirit of wine, the vinous decoction of the aromatic herbs, with the addition of sea salt, myrrh, and aloes; in short, all those topical applications which are capable of hardening, and rendering the gangrenous eschar, to use the expression, coriaceous, so that it may resist as long as possible the fatal rupture of the aneurism.[h]

§ 20. Lastly, With regard to the assistance of the hand in the *radical* cure of external aneurisms by means of the ligature of the artery, whether it is thought proper to open previously the aneurismal sac, or to leave it untouched, the operation requires intelligence and dexterity on the part of the surgeon. The first of these he will acquire by means of dissection, and he may obtain the second by practising the operation of the ligature upon the dead human subject, and successively upon brute animals. I have frequently had an opportunity of applying the ligature on the arteries of brute animals; and some experiments which I made with regard to the *transfusion* of the blood[i] have proved to me, that a surgeon may, without difficulty, acquire, by practising on animals, a certain tact, to use the expression, and an unusual degree of quickness and dexterity in laying bare, separating, and handling the arteries and tying them, although they be wounded, and pouring out blood with impetuosity, as likewise in giving to the ligature that due degree of constriction proportioned to the size and density of the artery to be tied.

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[h] Some years ago, a case of aneurism of the aorta occurred in Guy's hospital, which had destroyed a portion of the sternum, formed a large tumour externally, and threatened to burst. Mr. Astley Cooper preserved the life of the patient for several days, by applying successive layers of adhesive plaster over the tumour; in this manner, aiding and imitating nature. *T.*

[i] Rosa. Lettere Fisiologiche.

CHAPTER IX.

OF THE CURE OF THE POPLITEAL ANEURISM.

§ 1. SINCE there are only two methods in surgery for accomplishing the radical cure of external aneurisms, *compression* or the *ligature* of the injured artery, it is necessary, in the first place, to examine, in treating of popliteal aneurism, in what circumstances the preference ought to be given to the one or to the other of these two methods of cure. Compression is not a mode in which much confidence of success can be placed for procuring the radical cure of popliteal aneurism, except in those cases, in the first place, in which it is very probable that the rupture of the popliteal artery is owing to an external cause, as, for instance, a wound or violent strain, rather than a slow morbid degeneration and subsequent ulceration of the proper coats of the artery; in the second place, that at the seat of the tumour in the ham there is a possibility of pressing the two opposite parietes of the lacerated popliteal artery against the inferior and posterior surface of the thigh-bone; and, in the third place, that the degree of pressure which can be employed is sufficient to excite deeply in the proper coats of the popliteal artery the *adhesive* inflammation, by which this artery is finally converted into an impervious ligamentous substance.

§ 2. The combination of these three circumstances in relation to the popliteal aneurism, without which the compression is of no avail, or rather injurious, is indeed a very rare occurrence. For, we shall even suppose (which is very rarely the case), that the coats of the popliteal artery have not been so much disordered and disorganized from internal causes previous to the violent straining, as to have lost, for a certain space above and below the rupture, all disposition to inflame and adhere together, the surgeon has for the most part many other very great difficulties to encounter, which prevent him applying upon the artery that exact and steady degree of pressure which is requisite for obtaining the complete and radical cure of the aneurism in the ham. It is necessary that the compressing force applied to the aneurismal sac of the ham press down and remove from the artery the concentric coagulated layers of blood, so that the pressure may fall precisely on that portion of the popliteal artery immediately above its rupture. This cannot take place except in a case of very recent popliteal aneurism, of very small size, and in which the cellular membrane and ligamentous bands surrounding the popliteal artery permit the clot of blood to retire from the place it occupied, and descend below the laceration in the artery which we wish to compress. Besides this, it is necessary that the compression do not injure the great sciatic nerve, especially its large tibial branch. This is very difficult to effect, both because this nerve runs on the back of the aneurismal sac, and because it is situated superficially and immediately below the integuments and aponeurosis of the ham, and too great a compression of it is sufficient of itself to render this mode of cure of the popliteal aneurism insupportable and ineffectual. We may farther add, that, in order that the compression be effectual, it is necessary that the laceration or corrosion of the popliteal artery be neither too high up in the ham, as, for instance, at the place where the femoral artery passes through the tendon of the long portion of the adductor *magnus* muscle, nor too low in that cavity, so as to be seated under the heads of the great muscles of the calf of the leg where the popliteal artery divides into the tibial arteries. For, in the first case, or when the rupture is too high in the ham, the compression, on account of the straitness, deepness, and obliquity of the place, can with difficulty cause the two opposite parietes of the popliteal artery to approach above the seat of its rupture or ulceration. In the second place, when the rent of the artery is too low in the ham, the deepness of the situation, in like manner, and the thickness of the surrounding muscles of the calf of the leg, render the force of the pressure on the artery ineffectual. And suppose, that notwithstanding, in this last case, the surgeon, by increasing very much the compressing force, succeeds in compressing the popliteal artery against the posterior surface of the heads of the tibia, the obstruction of the *inferior* articular arteries, and, what is still more important, of the tibial arteries, and the gangrene of the leg, are the inevitable consequences of such an attempt. In relation to this point, Guattani,[a] with his usual ingenuity, remarks, ‘ I have been engaged in searching ‘ for a mode of compression, by means of which I ‘ might be enabled to cure the aneurisms that oc-

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[a] De externis aneurysmat. pag. 74. Studui quoque ut viam invenirem aliquam ad ea persananda aneurysmata, quæ in superiori suræ parte contingunt, in quadam scilicet ex tribus arteriis; quæ sunt tibialis anterior, tibialis posterior, et peronea; sicuti etiam ad ea aneurysmata persananda, quæ obsident extremum poplitex, priusquam in tres prædictas arterias ea diducatur. Sed licet quater id pertentaverim, nunquam tamen ex animi sententia res hactenus

'cur at the upper part of the calf of the leg, which 'affect one of three arteries, viz. the *anterior* tibial, 'the *posterior* tibial, and peroneal, as well as those 'which are situated in the lower portion of the popliteal artery, just before it divides into these great 'branches. But although I have now made the attempt four times, the event has not hitherto corresponded to my wishes.'

§ 3. On this important subject, it does not appear to me to be difficult to establish a fixed rule, by which every surgeon may be enabled to determine, without hesitation, the cases in which it is proper to employ the compression, as a radical mode of cure of the popliteal aneurism. This rule, in my opinion, might be the following. The compression is contraindicated, whenever the popliteal aneurism is *spontaneous*, or not depending upon a wound, or extraordinary violent stretching of the artery; when the popliteal aneurism is of long standing, and of prodigious size; when it is very hard; when it occasions acute pain, and sympathetic fever; when it has produced considerable swelling of the leg and foot, with a diminution of their heat; and when the aneurismal sac is situated too high, or too low, in the ham. On the contrary, the surgeon's hopes of a cure being obtained by compression, will be well founded in every case, where the popliteal aneurism is very small, recent, and produced by a violent stretching of the artery; when it is indolent, soft, and yields to the pressure of the hand; when it is situated exactly in the middle of the cavity of the ham; and when it is not accompanied by swelling or numbness of the leg and foot. If, however, notwithstanding the combination of all these favourable circumstances, which, I again repeat, is very rare, on the first methodical application of the compression, pain shall be excited in the tumour of the ham, which the patient finds not easy to bear, and if the leg becomes swelled and torpid, the surgeon will consider these symptoms as absolutely contraindicating the compression, and, notwithstanding the concurrence of the favourable circumstances now mentioned, he ought immediately to desist from the use of the compressing bandage. We have many examples in practice of this unfortunate combination of things, on account of which, in spite of the most promising hope, it has been necessary to desist from the compression very soon after it was applied. Nevertheless, as the desisting immediately from this method does not expose the patient to any danger; and besides, as we have the account of a great many successful cures of recent popliteal aneurism, obtained by means of compression, related both by the ancient as well as by the modern surgeons, of whom it is sufficient to mention Guattani and Flajani only, I therefore think that every sensible and humane surgeon, whenever this combination of favourable circumstances presents itself, ought to employ for some time the compression, as a method of cure of popliteal aneurism, instead of proceeding immediately to the operation and ligature of the artery; to which operation it is always time to have recourse, as soon as the first trials, prudently made, have shewn the inutility of the compression.

§ 4. The compression of the popliteal aneurism is performed in the following manner. In the first place, an expulsive bandage is applied to the toes, and to the leg, nearly as high up as the knee; then two large compresses are laid across, on the centre of the aneurismal tumour, which extend above and below th patella, and include the knee. A third compress, narrower, but longer than the others, is placed on th internal surface of the thigh, in the course of the *superficial* femoral artery. The first circle is made wit a very long roller, three fingers broad, on the centr of the tumour; then it is to be passed round the tumour, above and below the knee, so that the whol tumour is accurately and equably compressed. Th bandage is then to be carried upwards, encircling th thigh as far as the groin, observing carefully th every circle of the roller covers the other by a litt more than one half of the breadth of the bandag and it then terminates with a few circular turns roun the loins. The last turns at the top of the thig should be less tight than the others, and the neare these turns, in ascending, approach to the origin o the *profunda* femoral artery, the less tight they ough to be; since, in proportion to the advantage derived from moderating the impetus of the blood in the *superficial* femoral artery, will be the injury occasioned by preventing the free course of the blood in the *common* and *profunda* femoral arteries. This bandage should be frequently moistened with Theden's vulnerary water, or with vinegar and water, chiefly in order to keep it tense; since neither these fluids, no the so much celebrated plaster of Riverius, made o Armenian bole, terra sigillata, vinegar, and white o an egg, nor the gall-nuts, nor ice, are of themselve capable of causing a contraction of the artery, or o the aneurismal sac, without the compression. O every renewal of the bandage, the pressure on th tumour must be made stronger than before; and i proportion as the small, soft, and not painful ane rism in the ham diminishes, the number of the co presses is to be proportionally increased, so that the narrowest enter the bottom of the ham, and press on the popliteal artery exactly above the place of the injury, whilst the other compresses form outwardly, and above the ham, a prominence sufficiently great, that the force of the pressure may fall entirely on the artery which we wish to obliterate, without compressing the tendons of the flexors of the leg, or of the muscles of the calf of the leg, in the manner of a hard ligature. Galen, as I shall mention in another place,[b] put a piece of sponge immediately on the aneurismal tumour, and over the sponge graduated compresses, on which he tightened the compressing bandage.

§ 5. During this treatment, although the leg and foot should swell a little, provided violent and intolerable pains of the ham do not supervene, under the moderate and methodical pressure, and if the tumour decreases visibly, and does not beat so strongly as it did before, the surgeon may continue the application of the compressive bandage with hopes of success. In the meantime, if the patient is young and healthy, it will be proper that he lose some blood occasionally, and that he be kept on a very spare diet. If all goes on well, experience has shewn, that in the course of about three months the tumour gradually becomes smaller, loses its pulsation, and is reduced at last to an indolent tubercle, of the size of a bean. This state of things, however, ought not to be considered too soon as equivalent to a *radical* cure. Experience has shewn, that even when the disease is reduced to this state, the surgeon cannot pronounce with certainty that the cure is quite complete.[c] For, in many of those cases, in which the popliteal aneurism has been reduced, by means of compression, to the size of a bean, the artery has not been properly obliterated above the place of the injury, but there has only been formed a coagulated thrombus, which blocked up the rupture of the artery, and on this thrombus being removed by the impetus of the blood, and by the motions of the leg and knee, the popliteal aneurism appeared in the same place as before. On which account it will be proper that the surgeon should, in similar cases, continue the application of the compressive bandage for some time longer than three months, and that he should allow the patient to walk but very little, and with great circumspection.

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[b] Chapter xi, § 4.

[c] Palletta Giornale di Med. di Milano, t. vi, p. 183.

§ 6. It is proper again to repeat, notwithstanding all that I have several times mentioned, that the combination of the circumstances which favour the success of compression, as a method of cure of the popliteal aneurism, is a very rare occurrence; and that, most frequently, even in those cases in which every thing seems to favour the employment of this method with great hopes of success, the first attempts made with the bandage will prove, that, far from being beneficial, they rather do harm. On which account, whenever the compression is not indicated, and in like manner even when it is indicated, but in the first trials proves so painful that the patient cannot bear it, and when the swelling and numbness of the leg increase at the same time with the pain in the ham, it ought to be a fundamental precept in practice, to lose no time in useless attempts of this sort, and, if there are no reasons for the contrary, depending on the great age of the patient, or other local complications of disease, to proceed immediately to the operation of tying the artery. For, the longer we delay, the greater is the risk of the aneurism increasing in size; and, what is still worse, by delaying, the patient incurs the farther danger of the posterior and inferior surface of the femur being deprived of its periosteum, and even corroded, as usually happens in the progress of those large aneurisms of the aorta, which press on the sternum, the ribs, or the bodies of the vertebræ, and terminate in the destruction of their substance. Acrell is of opinion, that the operation for the popliteal aneurism cannot be deferred, without great danger, beyond a month after the appearance of the tumour; but this opinion appears to me to be much exaggerated, and in no way agreeing with the observations and numerous facts we are in possession of, from which we would draw a contrary conclusion; or at least, I am inclined to believe, that the possibility of the success of the operation extends to a much longer period than that which has been fixed by that, (in most respects), justly celebrated surgeon.

§ 7. The operation for the popliteal aneurism (having in view the general indication of cure of this disease) consists in suppressing, by means of the ligature, the course of the blood through the popliteal artery, so that the current of blood, which passed by this artery, is conveyed to the leg and foot by the different channels of the lateral anastomosing vessels. The effect, in respect to the primary indication which the surgeon proposes to accomplish, is the same, whether the ulcerated or lacerated popliteal artery is tied in the ham, a little above the place of the injury which has given rise to the aneurism, or whether this ligature is applied on the inner side of the thigh, in the middle, or at the top of the thigh; that is, we intercept the flow of the blood by the popliteal artery into the aneurismal sac, and successively obtain the obliteration and conversion of the ulcerated or lacerated popliteal artery into an impervious ligamentous cord.

§ 8. Every person who considers the facility, as well as the success attending the method at present practised by surgeons for the cure of the aneurism at the bend of the arm, occasioned by a puncture of a lancet, I mean by laying open the aneurismal sac, evacuating the clots of blood, and tying the brachial artery in the bottom of the sac, above and below the place of the wound, would be inclined to pronounce in favour of this mode of operating for the radical cure of the aneurism in the ham. But if, conversant in anatomy, and well acquainted with the causes producing the one or other of these aneurisms, he will bestow more mature reflection on this point, he will find that the circumstances, apparently similar in both cases, are not so in reality, in relation to the parts between which both of these aneurisms are situated, and to the causes from which these bloody tumours are derived. For, in the bend of the arm, the trunk of the humeral artery is found at a small depth, in comparison with the situation of the popliteal artery. The humeral artery can be easily brought into view, through the whole of the space which the surgeon finds necessary to enable him to separate it from the median nerve, to tie it without difficulty, and draw the ligature of a proper degree of tightness above and below the wound, without the smallest danger of obliterating, or including in the ligature, any of the more important anastomoses destined for maintaining the circulation and life of the subjacent part of the limb. In the aneurism at the bend of the arm, from the wound of a lancet, we never happen to find the bony substance of the lower extremity of the humerus bare in the bottom of the aneurismal sac. The proper coats of the humeral artery, if we except the solution of continuity made in it by the puncture of the lancet, are in a sound state round the place of the injury, and not at all disorganized, but disposed to inflame and adhere together. Finally, in the superior extremities, the vitality of the arterial system in particular, as of all the other parts, is greater than in the inferior extremities. On the other hand, in the ham the popliteal artery lies very deep. The space is very limited and narrow, within which the popliteal artery can be brought into view and tied, with the security of not including along with it, or destroying some of the principal anastomoses formed by the articular arteries of the knee. The management of the instruments, and especially of the needles, is very difficult, in order, at that depth, to make the ligature pass exactly behind the denuded popliteal artery alone, without including other parts in it: and it is no less difficult to draw the ligature on the popliteal artery with a proper degree of tightness in so deep a situation. The popliteal aneurism is, in most cases, the effect of a slow morbid disorganization of the proper coats of the popliteal artery; this disorganization, sometimes *steatomatous*, sometimes *ulcerated*, sometimes *earthy* and brittle, renders the ligature useless, when it is applied in the ham, and in the vicinity of the aneurism, either because the ligature easily breaks the artery, or because its morbid degeneration at this place renders it incapable of undergoing the adhesive inflammation. Besides, it very frequently happens, that the ulceration or laceration of the popliteal artery is so high up in the ham, that, in order to apply a ligature, it is necessary to divide the long p tion of the *great* adductor muscle, and make a p sage through it to the thigh; or it is situated so l down in the calf of the leg, that it is impossible avoid either including in the incision, or in the li ture, the inferior anastomotic articular arteries of t knee, on the preservation of which depends, in a gr measure, the circulation and life of the subjacent p of the limb. Guattani[d] encountered, as was to expected, so many difficulties, when the aneurism w situated low down in the cavity of the ham, that did not venture to attempt the ligature of the popl teal artery above and below the tumour, from t dread of including the sound inferior arteries in t ligature; and he was still farther dissuaded from th attempt, by considering the thickness of the muscl of the calf of the leg, covering the aneurismal sa If we add to all this the violence which must be don in every case, during the operation, to the great sci tic nerve, which an assistant must hold drawn to o side of the wound nearly the whole time of the oper tion; if we calculate the other great difficulties; a if it happens, as occurred to Masotti,[e] that the po liteal artery is so firmly united, and, as it were, co fused with the vein, the nerve, the tendons of the neighbouring muscles and the periosteum, the whole bottom of the ham presenting the appearance of an intricate mass of parts, not easily separated from one another. Lastly, we must not pass over in silence, that, after the division of the aneurismal sac in the ham, there remains a large deep wound, laying open the whole cavity of the ham; which wound, in most cases, changes into a foul ulcer, accompanied by copious suppurations, which exhaust the strength of the patient, and occasion successively fistulous sinusses, complicated with caries of the articular heads of the femur and tibia. If the patient is not hurried into his grave by these affections, and if even a cicatrix forms in the ham, it very rarely happens, that after so great a destruction of cellular substance, which occupied the cavity of the ham in the sound state, the patient does not remain with an incurable contraction of the knee, and perpetual lameness. Masotti,[f] whom I have already mentioned, relates the case of a patient operated on for a popliteal aneurism, in whom the subsequent suppuration destroyed the soft parts in the cavity of the ham, to such a degree, as not to leave any vestige of artery, vein, or sciatic nerve; from which circumstance, the patient remained all the rest of his life paralytic of that leg, with wounds and fistulæ all round the knee.

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[d] De extern. Aneurysm. p. 74. Superioris suræ. Non eq dem periculum feci vinciendum tantum arteriæ in principio et f tumoris, ob difficultatem inter tam validos musculos eam separa arteriam, quæ aneurysmati affecta fuerit, extricandique a reliq partibus tumorem integrum, absque eo quod sanæ etiam arte eodem tempore præcidantur. Nec ausus instituere arteriæ ejusd vincturam, aperiendo prius, evacuandoque aneurysmaticum saccu altitudo enim muscularis, ingensque tumor, quem ego semper offe di, (semper enim hujusmodi agrotantes ad chirurgiam sero confug unt), nimis difficile reddunt invenire modum vinciendi duo orific cum aneurysmaticæ arteriæ sacco communicantia.

[e] Dissert. sull' Aneurysma, p. 53.

§ 9. Young surgeons will find in Guattani[g] a very expressive and faithful delineation, of the very great difficulties and dangers, which are met with in the operation for popliteal aneurism, performed according to the method which was then commonly employed, or by means of the incision of the sac. ‘Having premised (says he) the proper precautions, I made an incision in the popliteal aneurism, lengthwise and having evacuated the grumous blood, I found the popliteal artery *lacerated in so great an extent* that it was impossible to apply the superior ligature until I had made a way upwards through the thigh with my fingers and the knife. Preparing then to tie the popliteal artery, under the aneurism, I was very much surprised to find this artery adhering to the femur, like an aponeurotic expansion just as the aorta is sometimes found to have contracted a morbid adhesion with the bodies of the vertebræ, and this adhesion prevented me applying the lower ligature, with the accuracy which is required in such cases. On loosening the tourniquet, no blood issued from the place of the upper ligature. I was, however, very much annoyed by the muscular arteries, which having been unavoidably divided, on account of the great extent of the wound, poured out a great deal of blood, which I endeavoured to stop by compression. I was induced to do this, as the ligatures would not have been sufficient to stop the hemorrhage completely, and because the patient did not seem to have sufficient strength to enable him to bear so long and so severe an operation. Having therefore filled the large cavity of the ham with dry lint, supported by compresses and a circular bandage, I finished the operation, leaving the tourniquet applied in case of accidents. The day after, although the tourniquet was loosened, gangrene nevertheless appeared on the knee, and the following day the patient died.’ A similar account, perhaps still more minute and explicit than that of

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[f] Loc. cit. p. 17, 24.

[g] De externis Aneurysm. Hist. i.

Guattani, of the difficulties and dangers of this operation, is given by M. Deschamps.[h]

§ 10. I am aware that other examples of success may be brought in opposition to this unfortunate case; but I likewise know, and many other surgeons agree with me in opinion, that these fortunate cases have been at all times very rare, and that the greater number of patients with popliteal aneurism, who have submitted to the operation by the incision of the sac, have died in convulsions before the third day, or have been attacked by gangrene of the knee, leg, or foot, a few days after the operation. And it is certainly to be attributed to no other reason, than the too frequent unsuccessful event of this operation by the incision of the aneurismal sac, that men, very celebrated for their learning, and long experience in surgery, such as Mr. Pott,[i] M. Deschamps,[k] and Palletta,[l] have openly declared, that till we discover a better mode, amputation of the thigh ought to be preferred to the incision of the popliteal aneurismal sac. Wilmer states distinctly, that the operation for aneurism had been performed several times in the hospitals of England, within the course of a few years, but that he had not heard of a single case which had done well.[m] And although of late years, improvements have been made on the needles for applying ligatures to arteries when deeply seated, and although instruments have been invented for compressing the great arteries, yet no useful or essential change has been made in the general plan of the operation for popliteal aneurism by the incision of the sac. For, notwithstanding these improvements on the instruments, there exist still the same difficulties, and the same dangers depending upon the depth and extent of the wound in the ham, on the injury done to the great sciatic and tibial nerve, on the state of disorganisation of the proper coats of the popliteal artery, both at the place of the rupture and where the ligature is applied; and also, on the popliteal aneurism being sometimes situated too high or too low; and finally, on the very severe consequences of an ulceration so extensive as that of the whole cavity of the ham.

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[h] See Appendix, note, No. 12.

[i] Chirurgical Works, t. iii, pag. 414. Sorry I am to find myself obliged to say, that as far as my observations and experience go, such operation, however judiciously performed, will not be successful, that is, will not save the patient's life. In both these aneurisms, the femoral and popliteal, it most frequently happens, that the artery is not only dilated and burst, but it is also distempered some way above the dilatation, particularly in the popliteal. This may very probably be one reason why the ligature is in general so unsuccessful.

[k] Loc. cit. pag. 68. On cite ici quelques examples de réussite; deux ou trois par M. Pelletan, un par Desault, et aujourd'hui un à l'hôpital de la charité; mais les non-succès les a-t'on comptés? Plusieurs fois depuis, Desault n'a pas réussi. Il y a plusieurs années, une malade que j'ai opéré à l'hôpital de la charité a eu la jambe sphacelée; un opéré derniérement a eu le même sort. En général dans les operations on a toujours grand soin, comme je viens de le remarquer, de noter ses succès; mais les non-succès on les passe sous silence. J'apporterai en preuve l'assertion d'un

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de nos plus célèbres praticiens, qui dernièrement, et en publique, a dit, en parlant de cette operation, que s'il avoit le malheur d'être attaqué d'un anéurisme de l'artére poplitée, il prefereroit l'amputation de sa cuisse à l'operation.

[l] Giornale di Venezia Marzo 1796, n. iii. Those, says he, who were operated on in this manner by my predecessors, had all an unfortunate termination.

[m] Cases and Remarks in Surgery, p. 180. It hath been done several times within these few years in our public hospitals, but I have not heard of any one case where it answered the intended purpose.

§ 11. The above-mentioned difficulties and dangers, which are so often, not to say always, met with in performing the incision of the aneurism in the ham, and successively in tying the popliteal artery, immediately above the place of the injury, (some of which very great difficulties are of such a nature, that they cannot be foreseen by the surgeon before the incision and evacuation of the aneurismal sac), may be avoided by applying the ligature to the femoral artery in the thigh, higher up than the seat of the disease, instead of applying it to the popliteal artery in the ham, immediately above the root of the tumour, and by leaving the aneurismal sac quite untouched. The phenomena which present themselves after this operation, which is simple and not very difficult to perform, are the immediate diminution of the aneurismal sac; the stopping of the pulsation in it; the disappearance of the pain, which was before occasioned by the distension of the aneurismal sac. These phenomena are followed, in the course of a few weeks, by the obliteration of the popliteal artery in the ham, which was lacerated or ulcerated, or in some other way diseased or disorganised; the absorption of the extravasated coagulated blood in the aneurismal sac, and the gradual diminution, and final disappearance of the aneurism in the ham, with the exception sometimes of a slight induration caused by some portion of the compact cellular substance which formed the aneurismal sac, or some remains of the fibrous part of the blood. This slight hardness, which occurs in the bottom of the cavity of the ham, does not afterwards occasion any inconvenience to the patient, and does not at all hinder him in performing the motions of the knee and leg with quickness and safety.

§ 12. The ligature of the *superficial* femoral artery as an effectual method of curing the popliteal aneurism, frees the surgeon from the great perplexities in which he is involved, with regard to the seat and greater or less extent of the rupture of the popliteal artery, and also, from the doubts and uncertainty in relation to the complications of this disease, depending upon the morbid state of the proper coats of the popliteal artery, such as their *steatomatous*, *ulcerated*, *squamous* degeneration, and from the difficulties likewise produced by the intricate mass formed by the popliteal artery, with the vein, sciatic nerve, and other parts contained in the cavity of the ham. For, in following this method of cure, it is of little consequence to the surgeon whether the rupture of the popliteal artery has happened high up in the ham, or even at the place where the femoral artery passes through the long portion of the *great* adductor muscle, or if it has occurred low down, and in the vicinity of the *inferior* articular arteries of the knee. The surgeon is little, or not at all anxious, whether the brittleness, or *steatomatous*, *ulcerated*, *earthy* morbid state of the proper coats of the popliteal artery, extends even for a considerable way above and below the place of the rupture, or whether the popliteal artery is firmly agglutinated with the vein and sciatic nerve, or adhering to the adjoining parts, and even to the periosteum covering the posterior and inferior surface of the os femoris. Since, in whatever part the laceration is found, however brittle, diseased, and incapable of the *adhesive* inflammation, the proper coats of the popliteal artery may be, for a certain distance above and below the root of the aneurism, as soon as the *superficial* femoral artery is tied in the thigh, the popliteal artery ceases to pour blood into the cavity of the ham, and is obliterated afterwards at the upper part, and the same takes place in the lower part below the root of the aneurismal sac. When the rupture of the popliteal artery has occurred high up in the ham, this circumstance, far from being disadvantageous to the happy event of the cure, as it certainly is in the old manner of operating by the incision of the aneurismal sac, is rather favourable; since the higher up in the ham the laceration or ulceration of the popliteal artery has happened, there remains in the lower part of the ham the greater number of anastomotic articular arteries uninjured, and communicating with the superior ramifications of the *superficial* femoral artery and of the *profunda*, and with the branches of the *superior* articular arteries. In this case, it is true, we run a risk of destroying the *superior internal* articular artery, as it arises from the popliteal immediately after its entrance into the cavity of the ham; but we save the *superior external* articular, the two *inferior* articular arteries, the *azyga* of the knee, and the recurrent tibial. The blood therefore which passes from the superior branches of the *superficial* femoral artery, and from those of the *profunda* into the *superior internal* articular artery, if it cannot get from this last artery into the popliteal, takes the route of the *superior external* articular, of the *inferior internal* and *external* articular, and recurrent tibial arteries, and is poured into the popliteal artery below the laceration and aneurismal sac in the ham. The possibility of this, is proved by the numerous and constant anastomoses which all the articular arteries of the knee have with each other; and this point is likewise confirmed by injections, and in the most convincing manner by the following fact. A man, who had been cured by the assistance of nature, of an aneurism situated in the upper part of the ham of the left inferior extremity, in such a manner however, that in the course of the cure, the orifices of the superior articular arteries had been obliterated, having afterwards died of a stroke of apoplexy, Desault[a] injected the whole limb, in order to examine the part accurately. He found that the injection had passed both into the *superior* and into the *inferior* articular arteries, and that the superior articular arteries which had not been able to discharge the blood into the popliteal at the top of the ham, had transmitted the injection from the one to the other articular artery, and that they served, to use the expression, as intermediate canals between the great femoral arteries and the *inferior* articular and tibial arteries. Farther, he found in the substance of the sciatic nerve, an artery so much enlarged, as to form a communication between the sciatic artery and the *posterior* tibial. In the same manner, when the laceration or ulceration of the artery has taken place low down in the ham, since in performing the new method, it is by no means necessary either to open the aneurismal sac, or to apply a second ligature below the rupture of the popliteal artery, as I shall afterwards demonstrate, so the risk of destroying that portion of the popliteal artery, from which the tibial and *inferior* articular arteries arise, is not a subject of perplexity and of new fears to the surgeon, as they were to Guattani; in relation to which point, read case iii, at the end of this work. To all these reasons, which are alone sufficient to induce us to give the preference to the new method of operating over the old, we may add, that the incision of the integuments, and of the cellular substance, to bring into view and tie the *superficial* femoral artery at the middle or in the upper part of the thigh, is in no way to be compared to the large and deep division which it is necessary to make in the ham for laying bare the popliteal artery; that the ligature, according to the new method, being applied at a considerable distance from the place of the injury of the popliteal artery, it is much more probable, that it will include a sound portion of the artery, than when it is applied in the vicinity of the root of the popliteal aneurism; that no great nerve in the performance of the new method, appearing on the fore part, retards the operation, or renders it difficult or very painful to the patient. And lastly, it may be mentioned, that the suppuration occasioned by the incision of the integuments and cellular substance of the thigh, which is necessary for laying bare the *superficial* femoral artery, never produces so great a waste of substance, as is caused by the incision of the popliteal aneurismal sac, and the prodigious sloughing of the whole cavity of the ham, which is the consequence of it.[o]

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[a] See Appendix, note, No. 13.

§ 13. Some[p] have objected, that the *superficial* femoral artery, not being completely obliterated from below the ligature applied in the thigh, to the place of the ulceration or laceration of the popliteal artery, the collateral branches of the superficial femoral, which go off from above the ligature, communicating with the trunk of this artery below the ligature, and with the articular arteries of the knee, and severally with the *great* anastomotic artery, may continue to pour blood into the aneurismal sac, and thereby keep up the popliteal aneurism as it was before the operation. This objection, which is only a repetition of what Molinelli[q] had already advanced, rather as a sort of conjecture, than as the result of practical observations and experiments, with regard to the case of aneurism at the bend of the arm, operated on by Anel, without the incision of the aneurismal sac, is rendered void by facts in support of the contrary with regard to the popliteal aneurism; which facts are now so numerous, that they can no longer be regarded as rare events, or merely accidental occurrences. The facts, as I have said above, shew, that after the ligature has been properly applied to the *superficial* femoral artery, at the middle, or in the upper part of the thigh, the popliteal aneurism invariably lessens; that the pulsation in it immediately ceases; that from that moment, the aneurismal tumour gradually diminishes in size, and finally disappears altogether. These circumstances would not indeed invariably take place, if by means of the collateral anastomotic arteries given off from the

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[o] Deschamps loc. cit. pag. 76. Celle d'Hunter exige une incision de deux pouces de longueur aux tégumens; il ne s'agit que de soulever le bord du muscle couturier trés mince dans la partie de la cuisse où l'opération se fait. Le paquet des vaisseaux immédiatement placé dessous est à decouvert et facile à saisir; la plaie a peu d'étendue en longueur, et n'a pas, pour ainsi dire, de profondeur; on a l'avantagé d'opérer promptement, et d'une maniere sûre, et ce qui est un grand avantage, sur une partie qui n'est point altérée. Le gonflement qui suit l'opération est peu sensible; la suppuration est légere et la cure plus prompte.

[p] Caillot. Essay sur l'Aneurysme, p. 77.

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[q] Comment. Acad. Bonon. t. ii. Ut vero arteriarum aneurysmati insertarum numerus, et dispositio latiorem acum videantur non admittere; sic Anellianam operationem de qua agitur administrandæ rationem (quæ hujusmodi est, ut saccum, et continuatos cum trunco ramos retegat, hos deinde vinciat, illum intactum relinquat) inutilitate jam suspectam multo reddunt, et merito suspectiorem.—Non intelligo qui deprimi, et extenuare aneurysmatis saccus possit, in quem, ne totidem dicam, quot aliquando vidimus ut unus adhuc, aut alter eorum similis sanguinis rivus, post injecta vincula, pergat indesinenter influere.

superficial femoral above the ligature, the passage of the blood into the trunk of the femoral artery below the ligature still remained open, and from this artery, and at the same time from the articular arteries of the knee into the aneurismal sac. If Mr. Hunter in his first trial, found that the *superficial* femoral artery remained pervious for a certain space below the ligature applied in the thigh,[r] he however observed, that this artery was closed at its entrance into the aneurismal sac in the ham. The proof alleged by Guerin,[s] of the ligature of the femoral artery not being always sufficient to hinder the increase of the popliteal aneurism, because, that in a man operated on by him who died suddenly of hemorrhage in the night of the fourth day, the tumour was found of a greater size than it was before, is too inconclusive and inaccurate, to be opposed to the numerous other facts which may be adduced to the contrary. He ought to have shewn, in the most certain and unquestionable manner, that the superficial femoral artery had been tied with sufficient precision, and that the ligature had not slipped from the artery before the death of the patient. In the body of the man who had been operated on by Chopart, in whom the *superficial* femoral artery, a short time after the operation, was obliterated only for three fingers breadth below the ligature applied in the thigh, it was found, however,[t] that the *superficial* femoral artery, at its entrance into the aneurismal sac in the ham, was completely closed by a hard, tenacious clot of blood. Desault,[u] in the body of a man, in whom the so called *spontaneous* cure of a popliteal aneurism by the assistance of nature was just beginning, likewise found that a very hard bloody coagulated clot extended from the aneurismal sac in the ham within the femoral artery, and cut off all communication between this artery and the aneurism; and that the resistance of this coagulum was such, that the injection thrown in by the iliac artery, was obliged to pass to the leg and foot by the collateral arteries anastomosing with the articulars of the knee, and what is of importance to remark, without being at all poured into the aneurismal sac in the ham. In the body of another man operated upon by Deschamps,[x] who died from an infiltration of purulent matter in the thigh, the *superficial* femoral artery was found remarkably diminished in diameter from below the ligature downwards, and the aneurismal sac in the ham was likewise very much diminished in bulk, and only contained a hard clot and no fluid blood in its centre. ‘Boyer[y] dissected the body of a man who had died of an acute disease who eight years before had undergone the operation for an aneurism in the ham, performed according to Mr. Hunter's method. Deschamps had been the operator, Boyer had assisted him. The operation had had the most complete success, and the patient had been perfectly cured. The obliteration extended a little above and below the ligature; it was limited both above and below to the place from which a middling sized branch arose. The portion of artery included between the obliterated point and the aneurismal point was not obliterated, and the branches which went off from it, communicated evidently with those which came off from the crural artery, below the part obliterated. *The portion, however, of the artery which had formed the tumour* or

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[r] Transactions of a society, &c. vol. i.

[s] Journal de la Soc. de Santé de Paris, n. iii, p. 197.

[t] Deschamps loc. cit. p. 56. See case xi, at the end of this work.

[u] Chap. viii, § 3.

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[x] Loc. cit. pag. 59.

[y] Vacca'. Istoria d'un aneurisma del poplitè, p 34.

'*aneurism, was entirely obliterated*, presented at that 'point a considerable hardness, and was quite full 'and perfectly solid. The obliteration of the popliteal artery extended about fifteen or ſixteen lines, 'and the popliteal artery below this obliteration re'sumed its natural diameter.' Vacca'[1] mentions, that, in the body of a patient 64 years of age, who had been operated on for a popliteal aneurism by the mode of tying the femoral artery, in whom, from the diseased state of the proper coats of the artery, and from other unfavourable circumstances, which could not be foreseen, even after the long period of fifty-two days, the union of the two opposite sides of the tied artery had not taken place, he found that, while the femoral artery above the place of the ligature, as well as the collateral vessels, preserved a considerable diameter, greater than usual, the femoral artery below the ligature gradually diminished in diameter, in proportion as it proceeded downwards from the wound, or the place of the ligature, so that it was nearly obliterated some lines above where it loses the name of popliteal artery, and divides into the tibial arteries. At this point, the two sides of the popliteal artery were become much thicker than usual, and presented a very small aperture, from which there was an opening into a membranous sac, the parietes of which, had almost everywhere approached and adhered together.* These facts prove, that the *superficial* femoral and popliteal arteries, as well as the aneurismal sac, after the application of a ligature in the middle or at the top of the thigh, are capable of opposing the entrance of the blood into them, which is conveyed by the collateral vessels given off from the femoral above the pl of the ligature; and that they have at the same ti a tendency to contraction and obliteration, by me of which, after the ligature of the principal trunk, eit no blood at all enters the aneurismal sac by the col teral vessels, or if a small quantity enters at first, i not sufficient, either from its quantity or from the i petus with which it is impelled, to continue the an rism in the ham, or to prevent the gradual contr tion or disappearance of its sac. The coagulated cl which fill in concentric layers the cavity of the an rismal sac, and that portion of blood stagnating in t tube of the femoral artery from the place of the lig ture downwards as far as the aneurism, oppose strong a resistance to the streams of blood, whic from the collateral vessels, endeavour to enter t femoral artery below the ligature, and to get into t cavity of the aneurismal sac, that it is easier for t blood to pass from these collateral vessels into th open articular arteries of the knee, and from thenc into the tibial arteries below the aneurism, than t overcome the resistance opposed to them by the hard and tenacious bloody coagulum which fills up the aneu rismal sac, and the portion of femoral artery betwee the ligature and the aneurism. Haller[a] observed i the mesentery of frogs, that wherever the arteri blood found an obstacle to the continuance of its cours through one artery, it became at first stationary for little; it then took a retrograde motion towards th first anastomosis above the obstruction, and by th at last quickly resumed its course towards the subj cent parts. The same thing takes place, undoubtedl in the lower extremity after the ligature of the femor artery, both in relation to the blood which ru through those collateral arteries which arise from the femoral artery above the point of the ligature, as well as by those collateral branches which endeavour to pour blood into the femoral artery below the ligature, and into the aneurismal sac obstructed by the coagulum. This is the more easily prevented, as the articular arteries of the knee, even before the operation, are in general unusually dilated, and offer an open and expeditious route into the arteries of the leg below the aneurismal sac. We have, besides, demonstrated above, that even in a case in which the one or other of the *superior* articular arteries of the knee no longer opens into the popliteal, the blood nevertheless continues its course to the leg; for the *superior* articular arteries of the knee serve as a sort of intermediate canal between the collaterals of the *superficial* and *profunda* femoral, with the inferior articular arteries of the knee. And this is confirmed by a fact, which, from the frequency of its occurrence, may be regarded as invariable; that immediately after the ligature of the *superficial* femoral artery, the articular arteries of the knee beat with uncommon force, and sometimes as strongly as the radial artery at the wrist, which would not happen, if from the lateral vessels the blood found a greater facility in entering the femoral artery immediately below the ligature, and thence into the aneurismal sac, than in passing, as it does, through the same collaterals into the articular arteries of the knee, and from thence into the tibial arteries below the aneurismal sac.

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[1] Loc. cit. pag. 31.

* See also, in the Appendix, an account of a dissection by M. Deschamps. *T.*

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[a] Mém. i, sur le mouvement du sang, pag. 43.

§ 14. The objection, therefore, is of no weight, that the complete obliteration of the superficial femoral artery not taking place immediately after the operation, below the ligature as far as the aneurismal sac, the blood being conveyed by the collateral vessels into the tube of the femoral artery below the ligature, and into the aneurismal sac, may keep up and even increase the popliteal aneurism as it did before. For precisely the contrary of all this is proved by the dissection of the bodies of those who have died from other causes, after having been operated on for popliteal aneurism by means of the ligature of the femoral artery in the thigh, and by the inspection of the lower extremities of some others, where nature alone has begun a radical cure of this disease, in which cases the entrance of the femoral artery into the aneurismal sac has been invariably found obliterated, and where, if the femoral artery from below the ligature as far as the ham, has, in some rare cases, been found open, it was only so irregularly or at intervals, and these spaces were full of half fluid or coagulated blood. The same fact, or the diminution and disappearance of the popliteal aneurism, after the deligation of the femoral artery has been accurately performed, in the middle or at the top of the thigh, is proved in the living subject, in the most convincing manner, by constant observation, which would not happen, if it were so easy, as some pretend, for the blood of the collateral vessels to enter the aneurismal sac, or to flow into the trunk of the femoral artery immediately below the ligature. In support of this consideration we may add, that these phenomena are exactly in conformity to the laws of derivation, by the power of which the arterial blood is constrained to run in greater quantity, and with greater velocity, towards those places where it meets with the least resistance, which resistance being much greater in the canal of the femoral artery below the ligature to the ham, and into the aneurismal sac, on account of the partly hard, partly coagulated and polypous blood, which fills up these routes and stagnates there. And as the blood finds much less resistance in the dilated, pervious, numerous anastomoses above and round the knee, rather than force the obstructed portion of the femoral artery which is below the ligature and in the aneurismal sac, occupied by a hard tenacious coagulum, the blood necessarily takes the easy course of the articular arteries of the knee, and from these passes readily into the tibial arteries below the root of the aneurismal sac. And although in the examination of the body of some of those who have died soon after the ligature of the femoral artery, and in some others even several years after they had undergone this operation, it has been found, that the femoral artery below the ligature, as far as the ham was still pervious at intervals, we cannot from thence infer that this would be an obstacle to the *radical* cure of the popliteal aneurism. Because, in the first place, in all those patients who have been the subject of similar researches, the entrance of the femoral artery into the aneurismal sac has been constantly found shut; because, the artery being obliterated at intervals from the ligature downwards, the blood can never have a free passage within it to the ham; and lastly, because, if in the course of time the aneurismal sac is obliterated, we may with much greater reason assert, that, after a still longer period of time, the femoral artery ought also to be entirely obliterated in all those spaces that have remained filled by a portion of coagulated blood; recollecting also, that the coats of an artery are possessed of a vitality and of an elastic power much greater than that with which the cellular substance forming the aneurismal sac is furnished.[b]

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[b] Chap. viii, § 3.

§ 15. If, therefore, the resistance of the hard coagulated clot inclosed in the aneurismal sac, and th half-curdled coagulated blood, which at intervals obstructs the *superficial* femoral artery below the ligature, oppose a sufficient hinderance to the blood, which endeavours to enter from the collateral vessels, an oblige it by the laws of derivation to continue it course through the anastomotic arteries of the knee and from these into the tibial arteries, the same resistance will also necessarily produce another advantage, that is, it will oppose the return or regurgitatio of the blood from the tibial arteries into the sac of th aneurism. During this state, the absorption of th coagulum filling the aneurismal sac will take place, a it actually does, and then the aneurism contracting itself, and the popliteal artery being obliterated along with it, this artery will be converted into a ligamentous substance, impervious for some way above an below the ulceration or rupture. This contraction an obliteration of the popliteal artery does not, however pass beyond the orifices of the *inferior* popliteal articular arteries, because these orifices are below the coagulum which fills the aneurismal sac, and because the column of blood conveyed by these inferior articular arteries keeps the channel from the collateral vessels into the tibial arteries open and free. And, indeed, in all the dissections of the bodies of those who have undergone the operation for popliteal aneurism by means of the ligature of the femoral artery in the thigh, the communication between the *inferior* articular and the tibial arteries has always been found open. It is therefore a thing very deserving of our admiration, how the lamellated coagulum contained in the aneurismal sac, which before the operation was one of the most fatal consequences of the ulceration or rupture of the popliteal artery, after the ligature of the femoral artery is changed immediately into one of the principal means of cure of the aneurism. From which circumstance we may draw a useful conclusion in practice, viz. that in the operation for the popliteal aneurism by means of the ligature of the superficial femoral artery in the middle or at the upper part of the thigh, it is not necessary to apply a second ligature below the place of the laceration in the popliteal artery; since, for the reasons mentioned, the blood can neither flow back from the *inferior* articular and tibial arteries into the aneurismal sac, nor can the obliteration of the sac and of the popliteal artery, after the ligature of the femoral artery, descend so far below the ulceration or laceration as to shut up the communication between the *inferior* articular arteries of the knee and the tibial arteries; which is to be regarded as a favourable circumstance, and one of the most conducive to the perfection of the *new method* of performing this operation.

§ 16. Although the term *new method* is at present used in the schools to indicate the operation for the popliteal aneurism, which is performed by the ligature of the *superficial* femoral artery in the middle or at the upper part of the thigh, without opening the aneurismal sac, or evacuating the grumous blood contained in it, nevertheless this mode of curing aneurism by means of the ligature of the great artery of a limb, without touching the aneurism, and leaving it wholly to the powers of nature, and especially to those of the lymphatic absorbent system, is of a much more remote date than the time in which Mr. John Hunter lived, or the year 1785. For the history of this discovery goes as far back as the time of Anel, not however, as some think, still farther back, to the era of Guillemeau and Thevenin, from whom (in other respects celebrated surgeons) it is wished to make us believe that Anel had derived his first ideas relative to this manner of radically curing aneurism. Anel[c] being in Rome, undertook the cure of an aneurism in the bend of the arm in a missionary, and performed it in the following manner. Having laid bare the brachial artery above the seat of the aneurism, he separated it for a certain space from the cellular substance, and tied it with two threads contiguous to each other. On loosening the tourniquet, he found that the pulsation in the tumour had ceased. The day after, the pulse appeared at the wrist. On the third the dressings were renewed, and spirituous fomentations were applied to the whole fore-arm and hand. The first thread came away from the wound on the 17th day after the operation, the second on the 27th day, and not long after the wound healed. The aneurismal tumour gradually diminished spontaneously, in such a manner, that after the cure it was impossible to recognize where the aneurism had been situated. Generally, says Anel, the aneurismal sac is opened; I, on the contrary, says he, left it entire, considering it to be certain, that the blood contained in the sac of the aneurism would be dispersed of itself, precisely as it happened. In this manner, continues Anel, the operation was more simple than that which is usually practised. For, he observes, in tying the brachial artery, I made an incision less than that which is practised when the aneurismal sac is opened, therefore the scar resulting from it was smaller than usual. We have been lately informed, that M. Mirault[d] has repeated this mode of operating on the aneurism at the bend of the arm, occasioned by the puncture of a lancet, following exactly Anel's method, and that the operation has been followed by the most happy and complete success.

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[c] See Appendix, note, No. 13.

[d] Caillot Essay sur l'Aneurisme, pag. 72.

§ 17. It is therefore a certain fact, which has been known for a long time to well-informed surgeons, to name only Molinelli[e] and Heister,[f] and even before anatomy had furnished us with certain and accurate ideas of the arterial system of the extremities, and of the numerous anastomotic recurrent arteries at the bend of the elbow and round the knee, and likewise long before we were acquainted with the wonderful power and activity of the absorbent lymphatic system, that in a case of aneurism at the bend of the arm, if the brachial artery is tied above the seat of the aneurism, the aneurismal tumour being left quite entire, the aneurism immediately diminishes after the ligature of the great artery of the arm, ceases to beat, and finally disappears spontaneously, or by the powers of nature alone, without the fore-arm or hand losing their circulation, nourishment, or life. In the time of Anel, as well as of Molinelli and Heister, the surprising action of the absorbent lymphatic system was not sufficiently known; therefore, at that period, for the explanation of this phenomenon they had recourse to a certain internal motion of the blood, which made it re-enter from the sac into the wounded artery, and obliged it to continue its course within it. At present it is easy to make the transition from this false theory, and to appreciate the fact of the spontaneous disappearance of the aneurism in consequence of the ligaherself in the anastomoses of the superior extremities round the elbow, and of the inferior extremities round the knee, and fully aware of the prodigious efficacy of the absorbent lymphatic system, proposed to try this new plan of operating. The happy event which followed in the first patient on whom he operated, and the other similar fortunate successes obtained by him, as also those which in the sequel occurred in the hands of other surgeons, proved the justice as well as the great utility of the plan conceived for the cure of the popliteal aneurism; which discovery will form an eternal monument of glory to its author.

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[e] Acad. Bonon. t. ii.

[f] Institut. Chirurg. t. i.

§ 19. It has been said, that the first trials made in France with Mr. Hunter's method did not prove successful. But on this subject it is proper to observe, that, in the patient operated on by M. Desault,[b] the circumstances were not at all favourable to the success of the operation, and that the operation itself was not performed exactly according to Mr. Hunter's method. For, in the course of the cure, the aneurismal sac of the ham opened of itself, and caused a corruption of the soft parts and caries of the tibia, of which the patient died some months after the operation. Farther, the *superficial* femoral artery was not laid bare, and tied at the middle, or in the upper part of the thigh, as Mr. Hunter had done, but in the vicinity of the knee, or a little above the place where the artery perforates the tendon of the adductor *magnus* femoris, to descend into the ham; a situation very disadvantageous for allowing the femoral artery to be laid bare, and tied with facility at a small depth, and without dividing muscular parts. In the other patient operated on by M. Chopart,[i] it is said that the collateral vessels, and anastomotic arteries of the knee, had not corresponded with the intention of the operation; which remains still to be proved; since no mention is made of the age or constitution of the patient, nor of what bulk the popliteal aneurism was, nor of the date of the appearance of the tumour: all which circumstancces may be of such a nature as to make an attentive surgeon foresee the inutility of the old, as well as of the modern method of operating. For we ought not to pretend, as I have already said, in speaking of the cure in general, that the new method may be practised with success in every individual case of popliteal aneurism, and in whatever manner the disease may be complicated, depending upon the advanced age, the weak, and general sickly constitution of the patient, on the duration and very considerable size of the aneurism, on the state of inflammation, and of the aneurismal sac threatening to burst. Art has its limits; and since these points, relative to the diagnosis and prognosis of this disease, have been taken into more mature consideration,[k] the success of

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[b] Deschamps loc. cit. p. 39. Mr. Desault est le premier en France qui ait pratiqué l'operation de l'anéurisme poplitée suivant la méthode d'Anel; mais il y a apparence que les circonstances qui accompagnoient la maladie étoient peu favorable au succès de l'opération, puisque la tumeur s'ouvrit, et que le malade plusieurs mois après périt des suites de cette maladie compliquée de carie au tibia.

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[i] Deschamps loc. cit. Mais il n'etoit point au pouvoir de l'operateur d'etablir des collaterales propres à trasmettre une suffisante quantité de sang aux parties au dessous de la ligature.

[k] Deschamps loc. cit. p. 85. La méthode de Hunter ne devra point être employée si la tumeur anéurismale est douloureuse; ençore moins si l'extérieur est frappé d'une inflammation qui annonce une rupture des tégumens; si le genou, ou la jambe est engorgé; si le malade souffre dans cette partie; car, dans ces cas, il est presque

certain

the Hunterian operation has been more frequent also in France, and I may now say in all Europe. This has, at the present day, been carried so far, that Mr. Home did not hesitate lately to perform this operation on a patient, who had a popliteal aneurism in both hams, only interposing the space of fifteen days between each operation; which attempt was attended with the most complete success.[l]

§ 20. I now proceed to the detail of Mr. Hunter's operation for the radical cure of popliteal aneurism; and I shall mention those changes which practice has suggested to me ought to be made in it. Having arranged every thing with regard to the apparatus,[m] and a sufficient number of assistants being procured; having placed the patient on the edge of the bed, with his back and head a little more elevated than the hips,

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certain que le liquide contenu a éprouvé déjà une décomposition, et que le Kyste est enflammé, ou au moins dans une disposition prochaine à l'inflammation, et que la tumeur doit s'ouvrir; ce qui mettroit par la suite le chirurgien dans la nécessitée d'inciser le sac pour le vuider du sang corrompu qu'il contient, d'où résulteroit une double opération.

Nous avous eu, à Paris, quatre exemples de la ligature de l'artère fémorale à sa partie moyenne, à l'occasion de l'anéurisme de l'artere poplitée. Les opérations ont eté faites publiquement à l'hospice de chirurgie, et à l'hôpital de la charité; elles ne peuvent, ainsi que leurs résultats étre révoqué en doute. De ces quatre opérations une seule a été suivie du sphacèle à la jambe. On peut donc dire que la méthode de Hunter a eu du succès sur les trois quarts des opérés. Loc. cit. p. 64.

[l] Transactions of a Society for the Improvement of Med. and Chirurg. knowledge, t. ii, p. 235.

[m] This apparatus consists of a convex-edged bistoury; a small spatula; an eyed needle; two waxed tapes, each of them two lines in breadth; a small cylinder of linen rolled up, six lines in length and three in breadth; a tenaculum, and waxed threads for the ligature of the small vessels; lint, and a six-headed bandage.

with the leg and thigh of the affected side in a state of semiflexion, and supported on a pillow, the surgeon will direct one of the assistants to place himself at the side of the patient, so that he can, if required, compress the femoral artery as it passes out below the crural arch: I say, if it is requisite; for, except in the event of some unlucky or unexpected accident in the course of the operation, it is proper that the surgeon should have a full view of the pulsations of the femoral artery. The surgeon pressing with his fore-finger, will explore the course of the *superficial* femoral artery, from the crural arch downwards, and when he comes to the place where he does not feel any more, or very confusedly, the vibration of the *superficial* femoral artery, he will there fix with his eye the inferior angle or extremity of the incision which he proposes to make for bringing this artery into view. This lower angle of the incision to be made will fall nearly on the internal margin of the sartorius muscle, just where this muscle crosses the course of the *superficial* femoral artery, and at the apex of the triangle formed by the convergence of the adductor *secundus* and vastus *internus* muscles of the thigh. A little more than three inches above the place pointed out, the surgeon will begin the incision of the integuments and cellular substance with the convex-edged bistoury, and will carry the incision along the thigh, in a slightly oblique line from without inwards, following the course of the femoral artery as far as the point fixed with the eye, or to the apex of the triangle formed by the intersection of the two just mentioned muscles, and where this vertex is crossed by the sartorius muscle. He will divide, with one firm stroke, the skin and cellular substance, down to the thin aponeurotic expansion of the muscle of the fascia-lata, which covers the course of the *superficial* femoral artery; then with another stroke of the bistoury, with his hand free and unsupported, or upon a furrowed probe, he will divide along the thigh, and in the same direction as the external wound, the thin aponeurosis just mentioned,[a] and introducing the fore-finger of his left hand into the bottom of the incision, he will immediately feel the strong beating of the *superficial* femoral artery, and this without the necessity of removing the internal margin of the sartorius muscle from its position, or at least very little. With the point of the fore-finger of the left hand already touching the femoral artery, the surgeon will separate this artery from the cellular substance which ties it laterally and posteriorly to the contiguous muscles; making the point of the same finger pass gradually under and behind the superficial femoral artery, (supposing that the surgeon has not enormously large fingers), he will raise it alone from the bottom of the wound, or, when it cannot be avoided, along with the great femoral vein. If it is along with the femoral vein, holding the artery and vein thus raised, and almost without the wound, the surgeon, with a bistoury or spatula, or simply with the fingers of his right hand, will cautiously separate the vein from the artery, only in the space corresponding to the point of the finger which supports the artery. He will then pass behind the denuded raised artery a large, eyed, crooked needle, with a blunt point, carrying in the eye near to the point two waxed ligatures, each composed of six threads. After this the surgeon will withdraw the fore-finger of his left hand, on the point of which he kept the femoral artery raised from the bottom of the wound, and will proceed to the ligature of the artery. He will stretch the two extremities of the tapes, in order to place them near each other; he will then make with each a simple knot, and before tightening it on the artery, he will place between it and the knot a small cylinder of linen rolled up, six lines in length and three in breadth, over which cylinder he will tighten both ligatures with a simple knot, and with such a degree of force as he thinks necessary to bring the opposite sides of the femoral artery into complete and firm contact, not forgetting, however, that he compresses a portion of living solid. Over the first knot he will make a second, likewise a simple one. In making the simple knot, the surgeon is enabled to calculate the force which he employs in constricting the artery, which he cannot so well ascertain when he employs the double, or surgeon's knot, as it is called. Having made the ligature on the artery, he will cut away the ends of the ligatures on a level with the skin, or will bring them towards the upper angle of the wound, and cover them with a bit of linen. He will cleanse the wound from blood, and wash it with tepid water. He will then fill the bottom of the wound with soft lint, and cover the lips of it with a pledgit of simple ointment, and place over it a compress, retained by the six-headed bandage. He will lastly put the patient in a convenient posture; he will cover the leg and foot of the operated side with warm flannel, or with bladders filled with tepid water, and will make him take three ounces of an emulsion, with fifteen or twenty drops of Sydenham's laudanum.

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[a] Although the aponeurosis of the fascia-lata on the inner side of the thigh, where it covers the great femoral vessels, is very thin, when compared with that which covers the external surface of the thigh; yet, in laying bare the superficial femoral artery, it is proper to divide this aponeurosis, not only for the space of an inch, or as much as is required for insulating, raising, and tying this artery, but likewise above and below, in the whole length corresponding to the external wound. For, if this practice be neglected, it most frequently happens, that in the succeeding inflammatory stage, the bottom of the wound swells and becomes very tense; the inflammation is quickly prolonged through the aponeurosis of the fascia-lata, and the matter which is formed below it, not finding an easy exit by the wound, occasions abscesses, which very much retard the cure of the patient operated on for aneurism.

§ 21. The insulation of the *superficial* femoral artery, with the point of the finger passed behind and under that artery, corresponds nearly to the space which the two ligatures, placed near to one another, ought to occupy. Therefore, from not destroying more of the cellular substance which binds the artery to the neighbouring parts, than is necessary for placing the two ligatures, the artery continues to receive its nourishment and life immediately above and below the place of the ligature; which is an inestimable advantage, both with regard to the inflammatory course which the artery must pass through at the place of the ligature, and near to it, and with regard to the desired effect depending on this inflammation, I mean the adhesion of the opposite sides of the tied artery to each other. Mr. Hunter, in his first trial, applied four ligatures to the femoral artery, at a short distance from each other, to which he gave different degrees of tightness, so that the last or undermost was the one which really constricted and obliterated the tube of the artery. His motive for doing this, it clearly appears, was in order to moderate the impetus of the blood towards the principal ligature. But in doing so, he did not advert, that the three upper imperfect ligatures in contact with the artery, excited it to inflame violently, to suppurate, and to divide too soon, and thereby occasioned the severe accident of secondary hemorrhage. They were therefore omitted by him in his subsequent trials. For the same reason, I think, that, far from doing good, the placing at the upper part the so called ligature of *reserve* rather does harm; for this ligature destroys a greater tract of cellular substance, and insulates the femoral artery more than is necessary; and because experience has shewn, that whenever it has been necessary to have recourse to the ligature of *reserve*, it has rarely produced the good effect which was expected from it; as, on account of the retraction of the ruptured artery, it has been found, almost in every case, below the point of the artery which it was wished to compress. Farther, there is no great nerve which gives any trouble in the performance of this operation; for there are only filaments of the anterior crural nerve* on the anterior and internal surface of the thigh, and at the precise place where the *superficial* femoral artery is laid bare, there are no nervous twigs met with, except those which unite together to form the saphena nerve; thin filaments, which may be divided without any injury, in the act of bringing the artery into view. As to those nervous twigs which adhere to the *superficial* femoral artery, they may be separated in laying bare and separating the artery from the cellular membrane; or, if they even remain along with the artery included in the ligature, the loss of them has no material influence in relation to the sensation and motion of the lower extremity.

§ 22. The phenomena which follow this operation are, the total ceasing of the pulsation of the aneurismal tumour in the ham; the immediate sensible depression and flaccidity of the aneurism; the disappearance of the pain in the seat of the tumour; the strong vibration of the articular arteries round the knee. The temperature of the leg and foot of the operated side remains, for some hours after the operation, lower than that of the sound limb, and the patient sometimes complains of a creeping sensation in the affected limb, or as if water were running down through the leg and foot. But by continuing the application of the flannel, and of the bladders half full of tepid water, and using frictions with some spiritous liquor, as camphorated spirits of wine, these parts soon re-acquire their original heat; and even in general, twenty-four hours after the operation, the heat of the operated limb, as ascertained by the thermometer, exceeds considerably that of the sound one. Afterwards, the increase and diminution of the heat of the operated limb, compared with the sound limb, is irregular, until the fifteenth or eighteenth day after the operation; after which time the heat of both inferior extremities comes to an equilibrium.

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* Fischer. tab. nerv. extrem. infer. tab. iv, fig. 1.

§ 23. The diet of the patient should be such as is proper in wounds of considerable importance. The dressings should not be removed till suppuration has begun, that is, not before the fifth day, in the cold season of the year. The dressing will consist in covering the ulcer with a pledgit of lint spread with any simple ointment, such as that made of wax and oil, which lint the surgeon will take care, at every dressing, to introduce to the bottom of the ulcer, so that the lips of it may not approach too quickly, and contract adhesions to each other, so long as the ligatures remain in it. Towards the fifteenth or eighteenth day after the operation, generally the one or other, or both of the ligatures are expelled from the wound together with the cylinder of linen. If occasionally at the time mentioned, and after the union of the sides of the tied artery has taken place, the ligatures are not disposed to come away, but are only relaxed in the loop, a probe is to be introduced into the noose, and along it the blunt point of a pair of scissars, with which the noose of the ligatures is to be cut, and then withdrawn from the bottom of the wound. After this there only remains a simple ulcer to be healed, the bottom of which, (provided the surgeon has employed proper care to prevent the union of the external lips of the wound), will rise regularly, and finally cicatrize, without the cure being retarded by purulent infiltrations or sinusses. And, in order more certainly to prevent these infiltrations of matter between the interstices of the muscles of the thigh, it will be proper, after the ligatures have come away, to keep the patient sitting on his bed, with his hips elevated as much as possible, and to apply a moderate compression to the thigh, extending from its upper part downwards, as far as the upper angle of the wound, by means of a bandage similar to the *spica of the groin*, which, after some turns round the pelvis, descends circularly along the thigh. It will likewise be proper that the patient should soon begin to extend and bend the knee gently, in order to prevent the rigidity of this joint, which might occur from the knee remaining long in a state of semiflexion. It happens in some particular cases, and principally when the ligature of the femoral artery is longer than usual of coming away, that the cellular substance which surrounds and accompanies this artery, above and below the place of the ligature, inflames violently, and becomes mortified, without the adjoining parts partaking of the affection. In these circumstances, the sinuous ulcer which is formed above and below the ligature, and in the course of the tied superficial femoral artery, does not heal until that portion of dead cellular substance is completely detached and expelled from the wound. This, in regard to the portion of cellular membrane, extending from the upper angle of the wound towards the bend of the thigh, is not long of taking place, after the ligature of the femoral artery has come away ; but it is not equally so in regard to that other portion of mortified cellular substance extending along the superficial femoral artery, from the inferior angle of the wound downwards, or in the vicinity of the place where the superficial femoral artery perforates the long head of the adductor magnus muscle to descend into the ham. In this case the portion of dead cellular substance occasions an abscess with a generation of air, which protrudes in the direction of the superficial femoral artery in the vicinity of the knee, and at the same time between the lower heads of the gracilis and semimembranosus muscles, with œdema round the lower part of the thigh and knee, with fever, a small frequent pulse, and great prostration of strength. The matter contained in this abscess can with difficulty be discharged, even after the ligature has come away, at the lower angle of the wound, and the small quantity which issues is putrid, fetid, and accompanied with bubbles of air. On the appearance of this accident, which is for the most part after the twentieth day from the operation, it is absolutely necessary to make a counter-opening in the vicinity of the knee, in the direction of the superficial femoral artery, and, if necessary, also between the lower heads of the gracilis and semimembranosus muscles. From these openings there issues at first a thin pale-coloured matter, very fetid, with a burst of air; it is then followed by the portion of dead and corrupted cellular substance; when this is detached and expelled, the general symptoms abate, the œdema round the knee disappears, the matter becomes healthy, the wounds put on an healthy colour, and quickly cicatrize. The accident just mentioned, however, as far as I know from my own experience, and the experience of others, takes place very rarely, in consequence of the operation we are treating of.

§ 24. While the wound goes on cicatrizing, the popliteal aneurism diminishes daily in circumference and depth, and by degrees the tendons of the flexor muscles of the leg are every day discovered more distinctly at the sides of the tumour. Towards the fortieth or the fiftieth day, the popliteal aneurism is found to be reduced to a small bulk, and the patient may then get out of bed. At first, notwithstanding the precautions which have been taken, he sometimes finds a difficulty in extending his knee completely, and especially in resting the weight of his body on it; but, encouraged and assisted by the use of embrocations and frictions, repeated several times a-day with warm olive oil all round the knee, and along the flexor muscles of the leg, he at last comes, one or two weeks after he has got out of bed, to extend the leg perfectly, and to use it equally well as the sound one. The time in which the total absorption and disappearance of the aneurismal sac in the ham is effected, is in proportion to the size of the tumour, and the age and constitution of the patient affected with it. For the most part in the young and robust, in whom the popliteal aneurism does not exceed the size of a goose's egg, the disappearance of the tumour is effected in seven or eight months, and only leaves a very small, hard, indolent knot, which occasions no inconvenience, and does not impede the motion of the limb.

§ 25. Of all the steps of this operation, the following points deserve particular attention. 1. The place of the incision which I prefer, is in the upper part of the thigh, or a little higher than the place where Mr. Hunter used to perform it; in order to avoid the necessity of removing too much from its situation, or of turning back the sartorius muscle, for bringing into view and tying the *superficial* femoral artery below it. 2. The manner of insulating the *superficial* femoral artery from the cellular substance with the point of the finger, rather than with a cutting instrument, in order to prevent in this way the division of any collateral branch, and the insulating the artery only in that space which is required for the application of two ligatures near to each other, and of a cylinder of linen corresponding exactly to the breadth of the point of the finger, or a little more. 3. The ligature by means of two waxed tapes, of convenient breadth, placed behind and round the artery, near to each other, with the interposition of a roll of linen, of a cylindrical form, between the artery and the knot. 4. The express omission of the ligature of *reserve.* 5. The giving the preference to the simple, rather than to the double, or surgeon's knot. 6. The unremitting attention, during the subsequent cure, that the lips of the wound do not approach too near, and still more that they do not adhere together, before the ligatures and the roll of linen are expelled from the bottom of the wound, and till the bottom of the wound has risen nearly to a level with the integuments. 7. The timely incision or counter-opening in the case, although it is not frequent, of an abscess forming in the vicinity of the knee, along the course of the superficial femoral artery, occasioned by the portion of cellular substance surrounding the artery passing into mortification.

§ 26. Modern surgeons have found great fault with the needles commonly employed in the operation for aneurism; principally, because they are of such a form and curvature, that the point cannot be raised without pressing strongly with their handle against the recent and sensible lips of the wound. This is very true with regard to the ligature of the popliteal artery in the bottom of the ham, but the same difficulty does not occur in the ligature of the *superficial* femoral artery in the upper part of the thigh, especially if the surgeon takes the precaution of raising with the point of the fore-finger of his left hand the artery alone, or along with the vein, before passing with his right hand the needle armed with the two tapes behind the artery; for, in this manner of operating, the femoral artery is not found very deep-seated in the wound, and therefore the common eyed-needle for aneurism is sufficient for the purpose. In regard, also, to the tightening the knot upon the femoral artery, at the place where I have pointed out the incision ought to be made, there is no occasion to have recourse to any instrument, and still less to that denominated *presse-artère*, which some surgeons direct to be left in the bottom of the wound for some days; for it is certain, that the surgeon's fingers are sufficient to draw the knot, and tie the superficial femoral artery, at the place above pointed out, with the greatest facility, simplicity, and accuracy; which I can assert, from my own and repeated experience.

§ 27. As in all the cases in which it is proper to tie one of the great arteries of the second order, so in the new method of curing popliteal aneurism, one of the accidents which is more than any other to be dreaded, is *secondary* hemorrhage, whether it happens from over anxiety to remove the ligature, or from a premature laceration of the proper coats of the artery, brought on by too tight a ligature. This severe accident happened repeatedly to Mr. Hunter himself, after the ligature of the *superficial* femoral artery, and has happened to many other celebrated and skilful surgeons after him; and it is a fact well worthy of mature reflection, that this disaster, for the most part occurs between the tenth and fourteenth day after the operation. I have already said, that the ligature of *reserve*, most generally does not answer the intention, and that even, in all probability, it is to be reckoned among the causes producing this accident, to remedy which, the surgeon and assistants do not always arrive in sufficient time, from the patient losing a considerable quantity of blood, and from the strong commotion of his mind, bringing along with it consequences fatal to the event of the cure. Reflecting on this very important point of the cure of popliteal aneurism, and considering at the same time, that *secondary* hemorrhage very rarely, or never happens in consequence of the ligature of the *superficial* femoral artery after amputation of the thigh, in which this artery is drawn out and tied separately; and that on the other hand, this disaster was very frequent after amputation of the thigh, when the surgeons were in the habit of perforating the flesh with a crooked needle, and of tying the artery along with a great quantity of muscular and cellular substance, I think we may from thence justly conclude, that the *secondary* hemorrhage, in the case of aneurism, may be ascribed to the one or other of the two following causes, viz. to the inaccuracy of the surgeon in separating the *superficial* femoral artery from the cellular sheath in that portion over which he purposes to apply the ligature, or to the too great force which he employs in tightening the artery circularly. The union of the two opposite sides of an artery, as I have mentioned several times, only takes place by means of the *adhesive* inflammation, to excite which, and in order that it may produce the desired effect, it is necessary that the artery be not insulated too much, or beyond the limits of the ligature; that the degree of pressure be such as to put and keep the two opposite sides of it in complete and firm contact; that the irritation caused by the pressure, be sufficient to produce inflammation in the proper coats of the artery, without their passing immediately into a state of mortification from a want of vitality. If this degree of pressure is too small, the artery does not inflame sufficiently, and is not obliterated, but is rather wasted slowly, and then bursts; if the pressure is too great, and especially upon an artery insulated in a greater space than is required for the ligature, it mortifies, ulcerates, and opens before the sides of it have adhered to each other, both at the place of the ligature, and for a certain space above and below it.

§ 28. Both of these accidents may be avoided, by separating with the point of the finger, and insulating the *superficial* femoral artery from the cellular substance, in that portion only corresponding to the space which the ligature ought to occupy, which space is a little more than four lines. In stripping the artery in that part of its cellular sheath, it is to be done so that the ligature falls on the proper coats of the artery only, so that the surgeon can calculate with precision the degree of pressure which he ought to employ for keeping the two opposite sides of the artery in mutual and firm contact, without danger of being lacerated by the tapes, or thrown into mortification. The Arabian physicians, as I shall shew in another place, were very careful in the performance of this important article of practice, relative to the ligature of the great arteries of the extremities; for they invariably, before tying one of these arteries, not only laid it bare accurately for a certain space, but likewise, that the ligature which they applied might not include other parts than the denuded artery, they lifted up the artery with a blunt hook. The two waxed tapes which I propose to employ, placed contiguous to each other, each of which is two lines in breadth, rest upon a convenient space of denuded artery, on which account they can with difficulty produce its division. As the ligatures are only tightened upon the artery by the intervention of a cylinder of linen, placed on the artery lengthwise, and as the transverse diameter of this cylinder projects a little beyond the sides of the artery, it therefore follows, that when the knot is conveniently tightened, the sort of ligature formed by it is not, as commonly happens, a circular strangling, or puckering of the proper coats of the artery, but, properly speaking, an approximation of the two opposite sides of the artery for the space of four lines, or as if the artery in all that space were kept compressed and held between the points of the two fingers.[a] This, in my opinion, is the best mode the surgeon can take to prevent the rupture of the coats of a great artery, and to hinder their too rapid mortification, to excite in them a due degree of adhesive inflammation, to promote the union and obliteration of the cavity of the artery, and thereby remove the danger of *secondary* hemorrhage. Mr. Burchall,[q] in tying the *superficial* femoral artery circularly, as is generally practised, exposed the patient a few days after to a most dreadful *secondary* hemorrhage. He immediately passed a second ligature above the first, he inserted between the artery and the knot a cylinder of plaster, and then not a single drop of blood appeared during the whole time of the cure.

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[a] I have tried the mode of ligature here recommended, and I have invariably found that the proper coats of the artery are divided,

Mr. Thompson Forster,[r] besides the small compress or cylinder of linen, wished that over this there should be placed lengthwise a segment of a cylinder of wood, three quarters of an inch in length, and a third of an inch in breadth; but experience has convinced me, that the cylinder of linen alone answers the intention perfectly well. It is a constant fact, that the ligature applied in this manner, or by the interposition of a cylinder of linen, is much longer of coming away from the artery than the ligature performed in the common way. Experience has demonstrated to me, that the ligature applied in the first way is not detached from the femoral artery till the eighteenth, twentieth, twenty-first day, very rarely or never before the fourteenth day after the operation; while it is well known, that the ligature applied upon the same artery in the ordinary way, quits its hold most frequently the

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ed, as well as if no roll of linen had been interposed between the artery and the knot. *T.*

[q] Medical Obs. and Inquiries, vol. iii, p. 108.

[r] Medical Facts and Observ. vol. v, p. 6.

seventh or tenth day after the operation; a period at which surgeons are usually on their guard, from the fear of a *secondary* hemorrhage. If, as I have said above, to avoid this severe accident, it is necessary that the *ulcerative* process of the artery at the place of the pressure caused by the ligature happen after the *adhesive* process is perfectly completed, it is evident that the first mode of ligature, as that which is longer of coming away from the artery, will favour more than the other the perfect adhesion and obliteration of the artery, and will therefore more effectually remove the danger of secondary hemorrhage. This mode of preventing *secondary* hemorrhage, it is here proper to remark, is not at all new. The interposition of a small compress between the artery and the ligature, before drawing the knot, was practised by the ancient, especially the Italian, surgeons. They have all taught this precept relative to the ligature of arteries, particularly of a large size, and I do not know why so judicious and useful a practice has been abandoned. Heister[s] even speaks of it diffusely. Bertrandi also mentions it, in his Trat. delle Operazioni, t. iii, p. 195. And, in my opinion, it is incomprehensible why M. Deschamps[t] should regard this practice as useless and hurtful, while he found it convenient and useful to interpose, between the ligature and the artery to be tied, the metallic plate of his *presse-artére.*[u]

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[s] Institut. Chirurg. t. i, p. 269.

[t] Loc. cit. p. 35.

[u] Although the author has adduced, in support of his mode of ligature of the arteries, the authority of so many distinguished surgeons, I can by no means coincide with him in following the practice which he has so strongly recommended. We can have no doubt of the truth of what he asserts of its having been attended

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§ 29. Ætius,[v] after tying the brachial artery in two places at a short distance from each other, divided the artery between the two ligatures. Celsus [x] likewise mentions this practice, which was performed by many

with success; yet it will be difficult to persuade surgeons, who have been accustomed to consider the interposition of a foreign body as injurious, to adopt such a practice, though it be recommended by so high authority. The recent observations made in this country, on the effect of tying an artery, and the changes which follow it, shew that the author, from the very beginning of his ingenious reasoning, has proceeded on false principles, in considering it necessary merely to bring the parietes of the artery into contact, in order to produce their adhesion, and the consequent obliteration of the canal of the artery. The primary effect of the ligature, or its dividing the proper coats of the artery, has of late been so much the object of attention of every well-informed surgeon, that, in my opinion, it is unnecessary to detain my readers with any remarks on the subject. I therefore refer them, for a more ample detail, to the experiments related in Dr. Jones' work. With regard to the most proper mode of ligature, I think we can have now no hesitation in adopting that which Mr. Abernethy and many other surgeons have always found successful; I mean the application of two ligatures, and the division of the artery in the interspace. As, in a case of popliteal aneurism operated on by Mr. Astley Cooper, the ligature applied in this way slipped off from the divided extremity of the artery, Mr. Henry Cline proposed, that, after tying the artery, the ligature should be passed through its divided extremity, and tied a second time. This method was first mentioned by Dionis, and although it has of late been followed in several cases, as related by Mr. Dawson, yet I conceive that, in general, it will be found to be unnecessary, provided the ligature be applied with a due degree of tightness, so as to divide the proper coats of the artery. The ligatures ought to be made small, round, and perfectly regular. I would particularly recommend to my readers the attentive perusal of what the author has said with regard to the separation of the artery from the surrounding cellular substance, which, (whatever mode of ligature be employed), ought never to be continued further than the space required for the application of the ligatures. *T.*

[v] See chap. xi, § 21.

[x] De medicina, lib. v, cap. 16.

surgeons in less remote times, as Severinus, Gouey, and others, whom I omit mentioning, and then abandoned by all good practitioners.[7] At present, Mr. John Bell[8] and M. Maunoir[9] seem inclined to recal into use this method of tying the great arteries, or to finish the operation by the complete division of the arteries between the two ligatures, from the persuasion which they entertain of the efficacy of this method in preventing *secondary* hemorrhage. Maunoir asserts, that the muscular coat of the arteries is furnished not only with circular, but also with longitudinal fibres; and he is pleased to estimate the muscular retraction of the arteries at six lines, and at other six the retraction depending on the elasticity of the arteries themselves. I really do not know if any one has hitherto demonstrated the existence of longitudinal fibres in the muscular or in the *internal* coat of the arteries, as Van-Swieten pretends; but I am convinced that it requires a weight of eight pounds at least to break the femoral artery. It will be difficult for any one to persuade us, by a simple assertion or theory, that the action of the longitudinal fibres of the muscular coat of the femoral artery, however it may be excited by the irritation produced by the ligature, ever comes to exercise a force of retraction equal to eight pounds weight. The success obtained by Maunoir in a fox and in the arm of a man, are not sufficiently satisfactory to prove, that this division of the artery between the two ligatures is a sure method, exclusive of any other, of preventing *secondary* hemorrhage; for a very considerable number of facts may be related, from which it appears, that the femoral and brachial arteries have been tied in the common way, without *secondary* hemorrhage having occurred. Maunoir, in proof of his assumption, ought to have instituted comparative experiments, similar as to the circumstances of disease and of the subject;[b] on which point I can affirm, that in two cases, in which the ligature was applied after the method of Maunoir or Ætius, by two Italian surgeons celebrated for their learning and skill in practice, in both a *secondary* hemorrhage took place. Supposing even that this pretended favourable success of the method of Ætius was invariable, we would have to examine whether this depended more upon the hindered or apparent force of retraction of the arteries by means of the division, than upon the great care which the surgeon ought necessarily to employ in performing this operation, by removing the artery from the cellular substance accurately, and from the parts surrounding it, before tying it, just as is done after amputations, in which the artery is drawn out alone, and is constricted in a degree proportioned to its size and density; and these are the circumstances which are very often omitted or neglected in the case of the ligature of an artery on account of an aneurism. In the method of tying the great arteries, which I propose to recal into use, not only all these minutiæ are attended to, especially that of carefully denuding the artery as Ætius did, but also, by means of the interposition of the cylinder of linen between the artery and the knot, the artery is guarded from the circular constriction, which I regard as a very important article to be fulfilled, and likewise from the excess of pressure on its proper coats, which might produce laceration or mortification of the coats of the tied artery before the union and obliteration had taken place. And since the method which I have pointed out would include one of the principal advantages resulting from that of Ætius, viz. the laying the artery completely bare, and as I can adduce a considerable number of comparative facts in favour of this method, as capable of preventing *secondary* hemorrhage, it appears to me, that, in the actual state of our knowledge, the preference ought to be given to the above-described method of tying the large arteries by the interposition of the cylinder of linen, rather than to that of the circular ligature, and division of the artery between the two ligatures, the advantages of which last method in preventing *secondary* hemorrhage have not yet been proved in a satisfactory manner either by theory or by practice.

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[7] Heister. Instit. Chirurg. t. i, pag. 270. Callisen. Principia System. Chirurg. t. i, § 946. Arteriam inter vincula mediam discindere ob extremorum retractionem nocuum et superfluum merito habetur.

[8] Discourses on the nature and cure of wounds.

[9] Mém. Physiol. et pratique sur l'Anéurisme, et sur la ligature des artéres.

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[b] Vacca' loc. cit. pag. 40.

§ 30. With regard to the keeping the lips of the wound slightly separated after tying the superficial femoral artery, and until the ligature is expelled from the bottom of the ulcer, the utility of this plan of cure is proved both by the unpleasant consequences which resulted in Mr. Hunter's first trials,[c] when he healed the wound by the first intention, as well as by the advantages which he derived from following a local mode of treatment quite different from the first. For keeping the lips of the ulcer separated, I do not mean the cramming the sore with lint, but only the interposition at pleasure of a pledgit spread with simple ointment between the edges of the sore, so that its lips may not approach too near, and still less form adheions with each other, and prevent the exit of the ligature and of the matter. This precept, however, is only, properly speaking, the general rule adopted by all good practitioners in the treatment of ulcers which, from their situation and depth, and from the presence of foreign bodies in the bottom of them, may be complicated with phlegmonous congestions or purulent infiltrations under the aponeurosis and in the interstices of the muscles, whenever they are prematurely closed. Mr. Home,[d] notwithstanding the unfavourable results obtained by his great master, persisted nevertheless in the opinion, that, after the ligature of the femoral artery, it was proper to heal the wound by the first intention. But the facts which he himself relates are in opposition to his doctrine. For, of four patients, whose history he has related, in the two first indeed he cure was effected by the first intention; but in the hird, on the falling off of the ligature, a very considerable quantity of matter issued out by the wound, which continued for a long time, and obliged him to mploy a compressing bandage to prevent the infiltration. In the fourth patient the ligature remained so firmly embedded and compressed between the fleshy fibres at the bottom of the wound, that it could not be extracted till about a month after the operation.

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[c] Transactions of a Society for the improvement of Med. and Chirurg. Knowledge, vol. i.

§ 31. The aneurism in the ham, especially the *circumscribed*, produced by a wound of the popliteal arery, such as the stab of a sabre, sword, knife, or bayonet, or by a musket ball, the external wound being closed and cicatrized, may be radically cured by the new method, or by the ligature of the *superficial* femoral artery, as is done in that arising from an internal cause. If the aneurism in the bend of the arm caused by the puncture of a lancet may be radically cured by means of the ligature of the humeral artery above the aneurism, leaving the aneurismal sac untouched, as was done by Anel and Mirault, there is no reason to doubt that the same good effect will follow after the ligature of the femoral artery for the cure of aneurism in the ham produced by a puncture or wound of the popliteal artery. For, whether the blood be effused in the ham from a laceration or ulceration, or from a wound of the popliteal artery, the nature of the disease is the same; and further, in the case of a wound, if we except the solution of continuity produced by the wounding instrument, the surgeon has the full assurance that the proper coats of the popliteal artery are not at all disorganized for any space above and below the place of the injury, which there are strong reasons for suspecting takes place when the popliteal aneurism is occasioned by internal and not evident causes. And with regard to the old mode of operating, we must not flatter ourselves, that the aneurism of the ham being produced by a puncture or wound of the popliteal artery, there are therefore fewer difficulties to be encountered by the surgeon in the incision of the aneurismal sac, as was done formerly, with the intention of tying the artery in the bottom of the sac itself. Observation and experience have shewn, that whatever be the kind of aneurism of the ham, these difficulties are the same,[e] depending upon the depth and narrowness of the place, the opening which it is necessary to make in the ham, the in-y done to the sciatic and tibial nerves, the difficulty the undertaking of tying the popliteal artery accu-tely, and drawing the knot with a proper degree of htness at that depth above and below the place of e wound; and finally, on the danger of dividing or luding in the ligature one or more of the *inferior* ticular arteries, and on the extent of the wound to cured; all which very great difficulties and dangers ay be avoided by means of a simple and expeditious eration, as is that of the ligature of the femoral ar-ry a little above the middle of the thigh.

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[d] Transactions of a Society for the improvement of Med. and Chirurg. knowledge, tom. ii.

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[e] Deschamps. loc. cit. pag. 25. Blessure de l'artére poplitée.

§ 32. In a case of popliteal aneurism of very large ze, of long standing, and ready to burst, in a patient ther at an advanced period of life, with great swell-g and œdema, and little sensibility of the leg and ot, with acute pain in the seat of the tumour, with ell-founded suspicions of corrosion of the inferior d posterior surface, as well as of the heads of the mur and tibia, with a thin state of the aneurismal c and of the integuments, and symptoms of ap-roaching rupture, the circumstances are such, that cure could neither be effected by the old nor y the new method of operating. Experience has nfortunately shewn, that even amputation of the igh, always uncertain in its event, is still more so hen performed on account of a popliteal aneurism, which, except the fact unhappily too often confirm-l by experience, no plausible reason or explanation n be adduced. This combination of circumstances its the patient in imminent danger of losing his life, d the surgeon in a state of great perplexity about e plan he ought to follow. Penchienati[f] thought, that in this extreme case it would be less hurtful to amputate the leg than the thigh; but hitherto surgery has not supplied us with facts confirming the justice and utility of this doctrine. I am inclined to think, that, instead of amputating the leg, it would be more useful in this case to disarticulate it at the knee. In the first place, because, as has been inculcated by Hildanus, and afterwards by Brasdor,[s] and from what I have had repeated occasions to observe, disarticulations are much less subject to be followed by severe symptoms than amputations; in the second place, because, in making the disarticulation of the knee, turning the patella upwards, dividing the *lateral* and *crucial* ligaments, and carrying the incision posteriorly downwards towards the calf of the leg, the aneurismal sac is evacuated in such a manner, that the popliteal artery may be tied beyond it as high up as the seat of the rupture requires. I would not dread much in this case the corroded state in which the posterior and inferior surfaces of the thigh-bone are usually found, since this is, properly speaking, not a caries, but rather an excess, to say so, of absorption of the bony substance, occasioned by the violent pressure which the aneurismal sac, and the clots contained in it, have exercised on the bones; on which pressure being removed, there is every reason to believe that the bony substance will re-acquire enough of vitality at the place of the corrosion, to assume the process of granulation and cohesion with the soft parts which surround the stump. There would be more cause, in cases of very large aneurisms of long standing, to dread the state of

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[f] Mém. de l'Acad. R. de Turin, an. 1784, 1785.

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[s] Mém. de l'Acad. R. de chirurgie, t. v. Le danger de l'amputation est en raison de la quantité retranchée de la surface de la plaie, de la nature des parties coupées, et des accidens qui peuvent suivre l'operation.

steatomatous, *ulcerated*, *earthy* disorganization of the popliteal artery in the cavity of the ham, and at a considerable distance also above the place of the rupture, from which the ligature applied in the ham would be rendered unsuccessful; in regard to which accident, it would be a subject of discussion, whether, before disarticulating the leg at the knee, it would be proper to tie the *superficial* femoral artery in the upper part of the thigh rather than in the ham. In the perplexed circumstances of which we are speaking, considering as proved the almost constant unhappy event of amputation of the thigh in similar cases, I would not hesitate a moment to adopt the plan of operating just pointed out; that is, I would prefer the disarticulation of the knee to the amputation of the thigh; and I would previously apply the ligature of the *superficial* femoral artery in the upper part of the thigh before disarticulating the leg at the knee. There can be no doubt, that, by operating in this way, the surgeon would have the greatest probability of tying the femoral artery, not only quickly, but also of tying it in a place where the coats of the artery would be sound, and in a state of undergoing the adhesive inflammation. Farther, by making the disarticulation of the leg, the surgeon would not be under the necessity of seeking, sometimes with great labour, the popliteal artery in the deep recess of the cavity of the ham, and be obliged perhaps also to divide the long portion of the adductor magnus, in order to make a way for tying the artery at a place where the coats of it did not partake of the disorganization which aneurism usually produces. The Arabian physicians tied the humeral artery in the vicinity of the axilla before proceeding to the incision of the aneurism in the bend of the arm, and notwithstanding this, the cavity of the bloody tumour passed regularly through the stages of suppuration to granulation and cicatrization, without there being any remarkable change in the circulation or life of the rest of the arm. There is no reason to suppose that the same thing would not take place with regard to the stump after the disarticulation of the leg at the knee, although the *superficial* femoral artery were previously tied in the upper part of the thigh. Examples and facts may be adduced in confirmation of this assertion. Mr. Antrobus,[h] surgeon, relates the following case. A man had his foot mortified after a malignant fever. By the use of bark and other proper remedies, the gangrene stopped, and separated two inches above the ancle. In spite of this, it was thought expedient to amputate the leg of this man at the usual place below the knee. Having cut it off, on relaxing the tourniquet, not a drop of blood issued from the great arterial trunks, nor could any pulsation be felt in these trunks at any point. Notwithstanding this, the fourth day after the operation the wound of the stump was found in a state of healthy suppuration, which was followed by a cicatrix, as in common cases. Wilmer[i] mentions, that he had observed a case similar to the preceding in a man, in whom, both at the time of the amputation and after it, no blood issued from the arterial trunks, and in whom nevertheless the stump suppurated and healed without interruption; from which this author very properly concludes, that in both of these cases the collateral vessels alone had had sufficient force to promote the suppuration and healing of the wound of the stump, and in the first case even at a considerable distance below the place of the obstruction or obliteration of the principal arterial

[h] Med. Observ. and Inquiries, vol. ii, pag. 152.

[i] Cases and remarks in surgery, pag. 175.

trunk of the lower extremity. In the case, therefore, of popliteal aneurism of long standing, just about to burst, and complicated with all the inconveniencies now mentioned, on account of which the whole inferior extremity cannot be preserved either by the old or by the new method of operating, if, instead of amputating the thigh, the preference were to be given, as it appears ought to be done, to the disarticulation of the leg at the knee, or to the amputation below the knee, the ligature of the superficial femoral artery in the upper part of the thigh, besides being applied in the sound part of the artery, would not at all hinder the collateral vessels having force sufficient to promote the suppuration, granulation, and healing of the stump. However, in the circumstances we are treating of, excluding entirely the amputation of the thigh, and adopting the maxim of tying the superficial femoral artery in the upper part of the thigh, experience and observation must determine whether the leg should be amputated below the knee, rather than disarticulated at the knee.

Finally, it has been remarked,[k] that in some cases, after Mr. Hunter's operation, mortification has attacked one or more of the toes, but that it has been confined to the toes. This accident, to the best of my knowledge, is very rare, and probably only occurs in some individuals advanced in life, or extremely weak and unhealthy. At any rate, if this should happen in any of these enervated individuals, the patient may console himself for the loss of one or two of his toes with the cure of a popliteal aneurism, having avoided submitting to the painful and dangerous incision of the ham, and to the tedious suppurations and corruption which follow it.

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[k] Deschamps loc. cit. pag. 114.

CHAPTER X.

OF THE CURE OF THE FEMORAL ANEURISM.

§ 1. The aneurism, which forms in the course of the *superficial* femoral artery, sometimes occupies the lower part, sometimes the middle or upper part of the inner side of the thigh, and sometimes arises very near to the crural arch. This aneurism is often occasioned by a wound of the superficial femoral artery inflicted by a pointed or cutting instrument, or by a musket ball; sometimes, like the popliteal aneurism, it arises from a slow morbid internal cause, such as a partial congenital relaxation of the artery, or a *steatomatous*, *ulcerated*, *earthy* disorganization of some portion of its coats, in consequence of which, on the occurrence of any accidental blow or violent strain, the artery bursts at that place, and an effusion of blood then takes place all round the vessel, and an aneurism is formed. In a case which came under my own observation, the occasional cause of the femoral aneurism was a violent exertion which the patient had made to free himself from a painful cramp of the fleshy part of the leg of the same side.

§ 2. If, as has been shewn, the ligature of the humeral artery cures radically the aneurism in the bend of the arm, and the obstruction and obliteration of

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[*] Case v.

he *superficial* femoral artery in the upper part of he thigh is sufficient to effect the *radical* cure of the popliteal aneurism, without the circulation being hindered by it, or the life of the leg and foot diminished, no one, I should suppose, would have any hesitation n believing, that the same expedient, or the ligature of the *superficial* femoral artery above the seat of the rupture of this artery in the thigh, will be a method equally effectual as in the case of popliteal aneurism, and even more certain in its effects for *radically* curing the femoral aneurism, without intercepting the circulation or cutting off the life of the subjacent limb, whether the aneurism occupies the lower part, the middle, or top of the thigh. For if, among the circumstances which secure the favourable event of the radical cure of the popliteal aneurism, we reckon one of the principal to be the preserving entire and pervious all or a greater part, especially of the *inferior* articular arteries of the knee, this favourable circumstance will certainly never fail to be present in the case of femoral aneurism, as the seat of the tumour is above the cavity of the ham, and so high, that the aneurismal sac cannot in any way compress or affect any of the anastomotic articular arteries of the knee, and still less the inferior ones of this class of arteries of the ham. It is of little importance that the trunk of the *superficial* femoral artery become impervious below the ligature, and be converted into a ligament. For, to preserve the circulation and life of the corresponding leg and foot, it is sufficient that the collateral branches which go off from the *superficial* femoral above the ligature, combined with those of the *profunda*, communicate with the recurrent articular arteries of the ham; a circumstance which in similar cases is never prevented.

§ 3. The first case of this kind, as far as I know, of which there is any mention in the records of surgery, is that related by M. A. Severinus,[b] from which it appears, that in a case of aneurism of the thigh, about eight fingers-breadth below the groin, occasioned by a musket ball, the femoral artery was tied above and below the rupture, with the most complete success. For, as Severinus relates, the patient by this means preserved not only the life, but likewise the power of making use of the lower extremity operated on, as well as of the sound limb. The noble boldness of M. A. Severinus, in tying the femoral artery in this case, cannot be sufficiently commended, as he acted contrary to the opinion of all the other medical men, except a certain Joannes Trullus; and still more, as it was opposed by the doctrine of Galen,[c] who, in speaking of the thigh, had declared, that it was impossible to save any one in whom the great artery of the thigh was wounded. It is a singular thing, that, even to the present day, the cure of which M. A. Severinus speaks, has been regarded by some as marvellous, and by others as referable only to a particular conformation[d] of the subject he operated upon, in whom it was supposed that the femoral artery was double, or divided into two, as the brachial is sometimes observed to be divided very high up, and even in the axilla into radial and ulnar arteries. And I am sorry to be obliged to mention among these, my master,

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[b] Chirurgiæ efficacis, part ii. Ennarratoria.

[c] De usu Partium, lib. iii, cap. 9. Arteria namque insigni earum quæ illic, in femore, statutæ sunt vulnerata, nullo pacto servatur.

[d] Heister. de arteriæ cruralis vulnere periculosissimo feliciter sanato, Dissert. § vi. Imo si forte non nisi unicus arteriæ cruralis truncus hoc in femore adesset sicut sæpe observari solet, subinde ne ligatura quidem arteriæ læsæ ad sanandum hoc malum sufficere,

,[e] who regarded this fact as a problem diffi-
lution, except we admit, in the patient ope-
)y Severinus, the possibility of a double *su-*
emoral artery; and this ought to excite the
prise, since we know, that at the time when
i wrote upon this point, the tables of Haller
very body's hands, in which were represent-
scular system of the lower extremities, and
ne time the anastomoses between the branches
erficial and *profunda* femoral with the recur-
ular arteries of the ham.

r whatever cause the femoral aneurism be pro-
hether it be by a wound, or laceration, or by
atous, *ulcerated*, *earthy* disorganization, with
and rupture of some portion of the *superficial*
rtery; since, in both of these cases, the im-
ause of the aneurism is the same, (viz. the
f the artery, and consequent effusion of blood
ellular substance surrounding the artery), the
of cure in all these circumstances must also
ne; that is to say, the obliteration of the *super-*
oral artery above and below the place where
y was wounded, lacerated, or ulcerated. I
arked;[f] that the aneurism, which, from any
ove-mentioned causes, is formed in the lower
in the middle of the thigh, most frequently
in a short time *diffused*, while that which ap-
the top of the thigh, as far as the distance of
gers-breadth below the crural arch, remains
g time *circumscribed.* This diversity of form,
nd quickness of increase between the inferior
rior aneurisms of the thigh, depends, as I have

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d. et causis morb. epist. i, art. 12.
vi, § 31.

said, upon this, that the inferior aneurism is only covered by a thin aponeurotic web of the fascia-lata, by a weak cellular substance, only opposing a feeble resistance to the blood, which by its quantity and weight, and by the declivity of the place, makes itself a passage between the *second* and *third* adductor muscles on the posterior surface of the thigh. On the other hand, the aneurism which arises at the top of the thigh, and in the vicinity of the crural arch, rests upon a layer of firm cellular substance, and is covered anteriorly by a portion of compact aponeurosis, extending from the fascia-lata upon the groin and upon the crural arch, by which the extravasated blood not being able to sink easily deep between the muscles of the top of the thigh, nor force the integuments outwards, generally forms at this place a *circumscribed* pulsating tumour, which remains very often stationary for a long time.

§ 5. Of the two methods which surgery possesses for effecting the radical cure of aneurism, *compression* and *ligature*, the former is completely excluded in a case of femoral aneurism, as invariably, or at least for the most part, useless and hurtful. The *superficial* femoral artery is not placed directly opposite to the thigh-bone, as the popliteal artery is, so as to be sufficiently and steadily compressed against that bone. The direction which it would be required to give to the compressing force would be from the inner towards the outer side of the thigh, subjecting at the same time the bodies of the adductor muscles of the thigh, which the patient cannot endure. And not being able to make the compression succeed in obliterating the artery, the pressure cannot fail to be an useless and hurtful method; both because, without pro-

; the end for which it was applied, it would cause
in and aneurismal sac to mortify, and because it
cause the aneurism, from being *circumscribed*, to
e *diffused*, and the extravasated blood would make
for itself between the adductor muscles on the
ior surface of the thigh, with great destruction
: cellular substance that ties these parts toge-
and would injure the great sciatic nerve. The
ession then is equally inapplicable in the aneu-
at the top of the thigh; because the cellu-
atum upon which the femoral artery rests, al-
h firm and compact, cannot offer a sufficient re-
e to the compressing force, so as to keep the
pposite parietes of the artery in complete and
ontact; and because it would be injurious to the
ation and the life of the subjacent limb, if the
ession were, without necessity, employed high
nd applied against the edge of the pubis, where
moral artery passes out below the crural arch,
bove the origin of the *profunda*. For which
n, the ligature of the *superficial* femoral artery is
ly and truly secure expedient which the surgeon
or the radical cure of the femoral aneurism.
peration, which is precisely the same as I have
bed in the preceding chapter, the sooner it is
med after the appearance of the aneurism, the
successful it is; since it is evident, that the small-
e more *circumscribed* and recent the aneurism
e less is the state of atony of the surrounding
ar substance, the quicker the absorption of the
ous blood, and the more rapid the disappearance
e tumour.

5. That Mr. Hunter's method, or we might
nel's, may be employed with hopes of success

for the radical cure of femoral aneurism, is a fact, proved both by dissection, and by those very facts which attest the favourable event of the cure of the popliteal aneurism, by means of the ligature of the femoral artery in the upper part of the thigh. I shall nevertheless relate some cases, which will serve more fully to confirm this truth. ' Cauzat,[1] a man about fifty years of age, a ropemaker, perceived a small tumour, of the size of a nut, in the superior and interior part of the left thigh. This tumour, when the patient was visited for the first time by the surgeon Lacoste, about six weeks after its appearance, was of the size of a small egg, and was accompanied by all the marks which characterise an aneurism. This disease was attributed to having taken mercury in too great quantities at different times. The cramps were blamed, by which the patient had often been tormented, and still more the violent motion in the exercise of his trade. The rapid progress of the tumour determined the surgeon Lacoste to perform the operation of the ligature of the femoral artery above the seat of the aneurism. Having therefore laid bare the femoral artery, he passed two ligatures round it, and placed them contiguous to one another. He tightened the inferior ligature, which not long after became loose, and obliged him to draw the upper one. On the tenth day after the operation, a hemorrhage appeared, which was ascertained to depend upon the femoral vein having been included and cut through by the ligature; but it was easily stopped. After this nothing worthy of remark occurred, and the patient was cured in the course of fifty-seven days.

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[1] Recûeil Periodique de la Societé de Med. de Paris, N. xxvi.

he femoral aneurism, immediately after the upper gature was tied, became soft and indolent; it then radually diminished in bulk, and, five months after he operation, was found reduced to the eighth part f its former size. The patient, after he was cured, did not require any support in walking.'

'Carthy, an artisan, thirty-seven years of age,[a] came into the hospital the 30th July 1794, to be cured of a femoral aneurism. The patient, nine months before, had perceived that there was a tumour at the place where the femoral artery is about to pass through the triceps muscle, to which he at first paid little attention, as it did not give him any remarkable uneasiness, and did not prevent him working. This tumour, which arose spontaneously, and had not been preceded by any external violence, remained stationary for about six months; it then began to be painful; no pulsation was evident in it till it had acquired the size of an egg. At this time the patient was advised to foment the part, and to anoint it with liniments; then to compress the tumour with a bandage; but all to no purpose. In the meantime, the tumour increased to a considerable size, and the whole of the subjacent limb became preternaturally swelled. The patient was of an hypochondriac, irritable temper, and low-spirited, and complained of acute pain in the whole of the affected limb, which however seemed to be relieved by the compression applied to the tumour. He was in this state when he came into the hospital. Having premised a venesection, the use of purgatives, and low diet, we proceeded to the operation the 11th of August. This operation consisted in laying bare the femoral artery by means of an inci-

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[a] Forster. Med. Facts and Observ. vol. vi, p. 115.

sion along the edge of the sartorius muscle, beginning about an inch below the origin of the *profunda*. Having denuded the artery, and passed a ligature round it by means of an eyed probe, the artery was tied, interposing between the artery and the knot a small compress of linen, and over it a segment of a cylinder of wood. The ligature being tied, the pulsation immediately ceased in the whole of the artery below. A second ligature was applied about half an inch above the first, to be used in case of a *secondary* hemorrhage occurring. Ten days after the operation the first ligature came away easily, and the day after the second also came away. The bulk of the tumour went on decreasing gradually, and in seven weeks the femoral aneurism was completely absorbed, so that the patient left the hospital perfectly cured.' The author makes the following remarks. 1, That although the femoral aneurism in this case was very large, yet the swelling of the limb was much less than in cases of popliteal aneurism of equal size. 2, That the femoral artery being tied very high up, the operation was followed by milder symptoms than when the artery is tied lower down in the thigh. 3, That the ligature came away of itself the tenth day, without occasioning any *secondary* hemorrhage. 4, That the aneurismal tumour was absorbed in a shorter time than is usually required in a case of popliteal aneurism, in similar circumstances.

I have likewise operated upon, in the same manner, and with complete success, a very large femoral aneurism,[1] situated much higher up in the thigh than either of the cases just related, as the tumour was situated little more than two inches below the origin of the *profunda* femoral artery. I had in this case an opportunity of comparing nearly all that had been observed by Mr. Forster. For, in the patient on whom I operated, although the tumour was about the size of an orange, yet the leg and foot were not at all preternaturally swelled; the operation was not followed by symptoms of any importance; and the absorption certainly went on more rapidly than usually happens in a case of popliteal aneurism of equal size.

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[1] See Case v.

§ 7. Whether the femoral aneurism is produced by an internal cause, that is to say, by a morbid state, or ulceration of some portion of the proper coats of the femoral artery, or by a cutting instrument, or fire-arms; provided the tumour is *circumscribed*, has increased slowly, and is not accompanied by symptoms of excessive distension of the parts which it occupies, and in particular of the integuments, Mr. Hunter's operation will always be the most expeditious, secure, and least painful method for the patient, which surgeons can employ for the radical cure of this disease. But in that species of femoral aneurism which is occasioned by a cutting instrument, or by fire-arms, it not unfrequently happens, that on account of the large laceration made obliquely in the femoral artery by the wounding instrument, the blood issues with so much impetuosity, and is effused in such quantity into the surrounding cellular substance, that in a short time it forms on the inside of the thigh a *diffuse* aneurism of prodigious size, by which the muscles being forcibly separated, and the integuments greatly raised, the vast tumour occasions intolerable pain, violent fever, prostration of strength, and threatens to inflame and burst.

In these urgent circumstances, the operation of Mr. Hunter is too slow in its effect to produce that degree of diminution of the tumour required for removing the excessive distension occasioned by the extravasated blood; therefore, in similar cases, it is proper to proceed quickly to the incision of the tumour, to evacuate the clots of blood, and to tie the femoral artery above and below the wound. This may be performed with the more confidence, as, the aneurism being produced by an incision or laceration of the artery, from an external cause, the artery preserves its disposition to unite, and to obliterate its canal immediately above and below the place of the injury. The inner side of the thigh, besides, allows an opportunity of performing this operation without great difficulties; which cannot be said in relation to the aneurism of the popliteal artery, by whatever cause it is produced.

§ 8. The operation to be performed is nearly the same as was performed in a similar case, with perfect success, by M. A. Severinus. The patient is to be brought to the edge of the bed, and an assistant is to be directed to compress the femoral artery as it passes out below the crural arch, making use of his thumb, or of a compress in the form of a seal, or a bandage rolled hard. The operator, with a convex-edged bistoury, will, with one stroke, divide the bloody tumour, in its whole length, in the direction which the *superficial* femoral artery naturally takes, endeavouring, as much as possible, to make the incision pass through the wound, or cicatrix left by it. Having evacuated the clots of blood, and washed the bottom of the tumour, the surgeon will immediately see the artery, and discover the place where it has been wounded.[k] The surgeon will introduce through the ncision or rupture a large probe, or a female catheter, and will raise the artery with it, while he detaches it with the point of his fore-finger for a small space from the cellular substance at the upper and lower part of the wound, and from the great femoral vein; then, by means of an eyed needle, he will pass behind it a waxed ligature about two lines in breadth. Then, turning the probe from above downwards, he will raise the lower portion of the femoral artery, behind which, and below the wound, he will pass in the same manner a waxed ligature similar to the first. He will then tie the artery above and below the wound, attending to place between the artery and the simple knot a roll of linen. Having suspended the compression at the crural arch, if any small arterial branch pours out blood, he will tie it separately, in the usual manner; otherwise, having again washed and cleaned the bottom of the bloody tumour, he will fill it with soft lint. The threads of the ligature should be placed in the two angles of the incision, taking care to roll them up in a piece of fine linen; and the part is to be covered with a compress retained by the four-headed bandage. The other parts of the cure will be conducted as has been mentioned in the preceding chapter.

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[k] M. A. Severinus was so much surprised at the readiness with which, after evacuating the clots of blood, the wounded femoral artery presented itself, on account, as he very justly remarked, of the separation which the blood had produced in the muscles of the thigh, and of the insulated state of the femoral artery, that he was induced to advise surgeons, in order to profit by this advantage, not to undertake the operation till as late as possible, unless they were forced to do it by hemorrhagy. ‘Multa equidem,’ says he, ‘in hoc casu sunt admiranda; tria tamen omnem admirationem superant; quorum primum; quod intervallo quadraginta dierum sanguis extra vas citra insignem putredinem potuerit conservari. Secundum, quod ita sanguis musculos ab invicem divulserat, ut eodem grumoso extracto, statim obvia nobis fuit arteria, ac si arte musculi separati fuissent, qui operandi commoditatem miram præbuerunt, unde hoc casu edoctus, omnibus non esse statim ad operationem confugiendum consulo, sed post adhibitam omnem industriam imo tardius quam serius, nisi hæmorrhagia ad manus cogat. Tertium, et ultimum, quod natura post alligatam arteriam eodem modo partem aluisse, ac si ab integra arteria irrigata fuisset, ut nec minor moli aut altera debilior robore remanserit. De efficaci medicina.’

§ 9. It is a very embarrassing and difficult situation in which the surgeon is placed in regard to the aneurism of the thigh, when the aneurism is inguinal, or occupies the top of the thigh a little below the crural arch. For, setting aside the uncertainty in which the surgeon is, whether the rupture of the artery include with the *superficial* femoral artery the origin of the *profunda* also, and whether the morbid state of the proper coats of the artery extend far above the place of the injury, the narrowness and shortness of the space between the point of the passing out of the artery from the abdomen, and the top of the tumour do not allow the operator to bring the femoral artery conveniently into view, in order to be able to tie it; or, in doing this, he is under the necessity of denuding this artery so high up, and so near to the crural arch, that he is obliged to include in the ligature with the *superficial* femoral artery, the origin of the *profunda* also; which combination of circumstances is one of the most unfavourable to the success of the operation. This article, therefore, deserves the most serious attention.

§ 10. We learn from dissection, that the bifurcation of the common femoral [artery into *superficial* l *profunda*, in a middle-aged man, takes place at an h and an half, sometimes at an inch and three quar- ı, very rarely at two inches, below the crural arch, er below this point. In twelve subjects of the ıe age and stature, in which I measured the dis- ce between the crural arch and the origin of the *funda* femoral artery, I found that this statement s correct. Now, supposing that the top of the fe- ral aneurism reaches to two inches below the cru- arch, (a very high position in the bend of the gh), and admitting also that the size of the aneu- n is equal to a large hen's egg, since it appears m certain and repeated observations, that the rent the artery always corresponds to the centre of the nour, or even, as some pretend, to the lower third the tumour,[m] the rupture of the artery in the case are speaking of will be a little more than an inch er than the top or upper part of the aneurism; it is, the rupture would be three inches below the ıral arch. Allowing the maximum of the distance m the crural arch to the origin of the profunda fe- ral artery, that is two inches, there will remain in s case somewhat more than an inch of *superficial* ıoral artery, upon which the ligature might be ap- ed without including the origin of the *profunda*. he aneurism was twice as large as a hen's egg, the tance remaining the same, that is, two inches be- en the crural arch and the top of the tumour, and posing that the place of the rupture of the artery responds to the middle or lower third of the tu- ur, there would be an opportunity of tying the *su- ficial* femoral artery at two inches below the origin

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Deschamps. Reçûeil Period. de la Societé de Méd. de Paris, , p. 57.

of the *profunda* ; a circumstance still more favourable than in the first case to the success of the cure.

§ 11. Since, therefore, the space of two inches from the crural arch to the top of the aneurism is too short for bringing into view and tying the *superficial* femoral artery, without running the risk of being obliged to tie at the same time the origin of the *profunda*, while from the top of the tumour to its middle there is enough of *superficial* femoral artery to allow of its being tied, independent of the *profunda*, it is evident, that in this case the best plan to follow is that of opening the tumour, by making an incision into the aneurismal sac from below to its upper part, in the manner and with the precautions I am going to point out. Having placed the patient in an inclined position on the edge of the bed, with the thigh and leg slightly bent, a skilful assistant is to compress the common femoral artery as it passes out below the crural arch. The surgeon will introduce a sharp-pointed bistoury into the lower part of the tumour, so as to enter the cavity of the aneurism, and with one continued stroke he will divide the tumour from below upwards to the top of the tumour, and contiguous to the fingers of the assistant who makes the compression. Having evacuated the clots of blood, and cleaned the bottom of the tumour with a sponge, the surgeon will immediately see at the bottom of it the rupture of the artery. He will introduce from below upwards, by this fissure, a silver female catheter, with which he will raise the *superficial* femoral artery. In doing this, he will take particular care to separate the *superficial* femoral artery from the *profunda*. This care is very necessary, as the *profunda*, immediately after its origin, runs for the space of an inch so near to the *superficial* femoral artery, that both of these arteries seem there to form only one cord. Having then separated these two arteries from one another, the surgeon, by means of the eyed needle, will pass a waxed ligature, about two lines broad, behind the *superficial* femoral artery, and he will take care to place it in the middle space between the edge of the rupture and the origin of the *profunda*; then turning the oint of the catheter from above downwards, he will aise the superficial femoral artery also below the rupture, round which he will in the same manner pass a second waxed ligature. He will tie the artery first at he upper part, then below the fissure, making a simple knot, and interposing a roll of linen between it nd the artery, and over the first he will make a second knot. He will direct the assistant to suspend he compression; and if blood is thrown out by any small artery, he will secure it in the usual manner. Finally, having washed and cleaned the bottom of the aneurism, and arranged the ligatures in the angles of he wound, he will fill the cavity of the tumour with soft lint, over which he will apply a compress retained by a six-headed bandage. The advantages of this node of operating, over Mr. Hunter's method, in he case of which we are treating, appear evident, rom observing, in the first place, that the surgeon s not hindered by the fingers of the assistant who applies the pressure: in the second place, that he obtains a sufficient space for laying bare the *superficial* femoral artery, and for separating it accurately from he *profunda*: that, in the third place, he can safely ie the *superficial* femoral artery above the rupture, preserving the origin of the *profunda*; which he could not do, for want of sufficient room, in employing Mr. Hunter's method.

§ 12. The case is much more alarming and puzzling when the aneurism is properly inguinal, and when it ascends so high as with its apex or upper part to occupy not only the crural arch, but extends likewise to the crest of the os ilium. Calculating even that the rupture of the artery corresponds to the middle point, or to the lower third of the tumour, it always happens that the ligature cannot be applied without including the origin of the *profunda* along with the *superficial* femoral artery. Here, therefore, the question occurs, whether, in similar distressing circumstances, the surgeon may tie the *common* femoral artery, with confidence of preserving the circulation and life of the lower part of the limb; in like manner, if he may flatter himself that so great a work may be accomplished by the action of the arteries serving as auxiliaries to the femoral; and supposing, even after the femoral arteries are tied, that so great a diminution in the quantity of the blood, (which in a given time used to invigorate and nourish the whole inferior extremity), may be made with safety, we must ask, if it is to be expected that the impulse which the blood receives from the auxiliary vessels, or those of the third order, can be sufficient to keep up the circulation and life of the subjacent foot, placed at so great a distance from the heart, or centre of circulation. At first sight, and even from the most accurate anatomical knowledge we are in possession of, with regard to the arterial system of the inferior extremities not affected with aneurism, it would seem that we ought to have very little, or absolutely no confidence, of preserving the lower extremity after the ligature of the *common* femoral artery; nevertheless, some practical observations, instituted by men worthy of credit, authorize us to maintain the contrary, and to admit the possibility of this surprising phenomenon, as well as to admire the extensive powers of nature, by means of which, and of apparently small resources, she is capable of repairing great losses. My own practice stops here entirely, and I have only as a guide the observations of Guattani, Gavina, Clarke, Mayer, the only ones with which I am acquainted. Guattani[*] relates the history of one Felix Morelli, by trade a goldsmith, who had an inguinal aneurism, which extended from the pubis to the crest of the ilium, and by which he was reduced to a deplorable state. This able surgeon undertook the *radical* cure of it, by means of compression applied to the denuded common femoral artery, against the os pubis, or against the ramus of this bone, extending towards the acetabulum. Seeing the impossibility of commanding the stream of blood by means of pressure made by an assistant upon the crural arch, the operator directed the surgeon Massimini to open the large inguinal aneurism from the top to the bottom. The blood instantly rushed out *per saltum* with great impetuosity, and successively in such quantity as to fill two large vessels, more than which was not collected, and was estimated to be about twelve pounds. After so great and so sudden an effusion of blood in a patient already much debilitated, Guattani proceeded to apply the compression on the denuded *common* femoral artery as it passes out from under the crural arch, and opposite to the ramus of the pubis, employing a number of graduated compresses, and a very tight bandage. The event of this operation was, that the hemorrhage was not only stopped by means of the compression of the denuded *common* femoral artery, but likewise the *common* femoral artery was obliterated as it passes out from below the crural arch. In the sequel, the wound suppurated kindly, and was covered by a cicatrix. The author assures us, that the patient preserved the power of using the inferior extremity which had been operated on, and that he had no other inconvenience than a slight degree of lameness. The observation made by Gavina,[p] and related by Guattani, tends to prove the same assumption. A man about 40 years of age, by trade a cook, of a cachectic venereal habit of body, and exhausted by a slow continued fever, had had an aneurism for three months in the left groin, of the size of a large fist, occasioned by an internal cause. The aneurism was attacked with gangrene, by which in a short time the aneurismal sac was destroyed, and at the same time the *common* femoral artery was obliterated for a considerable space from the crural arch downwards. The gangrenous parts separated notwithstanding, and the wound began to approach to a cicatrix, when the patient, greatly debilitated, was carried off by marasmus. In the course of about five weeks that this man lived after the obliteration of the *common* femoral artery above the origin of the *profunda*, not only the circulation and life of the whole limb below were preserved, but also the auxiliary arteries coming from within the pelvis shewed that they had sufficient force to limit the progress of the mortification in the parts round the aneurism, and to commence the process of cicatrization with great hopes of a cure. Gavina makes the remark, very justly, that this man did not die from a want of circulation and life in the subjacent limb, but from the inevitable effects of the extreme general debility. The case of the man observed by Dr. Clarke[q] was similar to this, in whom an aneurism supervened, after a violent blow in the left groin, which in the space of three months increased to the size of a melon, and was attacked by gangrene, and burst, without occasioning any loss of fluid blood. In this patient, as in the subject of the preceding case, the gangrene separated completely; and although the *common* femoral artery was obliterated above the origin of the *profunda*, the circulation and life of the subjacent limb were preserved. The wound had nearly healed, when the patient, from his own great want of care, exposed himself to an attack of an acute affection of the breast, of which he died. A country man, 60 years of age, Mayer relates,[r] had a tumour in the groin for three years, caused by having lifted from the ground and carried a great weight. He told me, that the tumour at first appeared about the size of an egg, and that it gradually became painful, and increased to the size of a small child's head. The thigh and leg were swelled, and nearly as thick as his waist. On examining the tumour, and observing it to be situated at the place where the *femoral* herniæ usually appear, Mayer adds, I conceived it to be a hernia; but as my attempts to reduce it did not succeed, I persuaded the patient to submit to the operation, as the only means of saving his life. It was undertaken by me in presence of Dr. Blumenthal After dividing the integuments, I found the fascia-lata much distended, which I perforated cautiously with the point of a bistoury, from which opening blood issued out as from a fountain, and I then discovered an actual pulsation in the tumour, and I was convinced at that moment of its being a case of aneurism. I abandoned all further operation, and covered the tumour with a compress retained by the *spica* bandage. I removed the dressings 48 hours after, and, to my great satisfaction, I found the tumour very much diminished. I afterwards renewed the dressings, and applied the expulsive bandage to the whole limb, and over the tumour some compresses, which I secured with a bandage kept moist with Theden's vulnerary water. Two days after, I renewed the bandage, as it had become loose, and found the wound almost quite closed, and the tumour still more diminished. At the end of three weeks, the aneurism, by this method of cure, was reduced to the size of an apple. I then applied to it a plate of lead covered with leather, which did not occasion any inconvenience to the patient; and he is now so well that he can do any kind of work. Here Mayer's account finishes. I am sorry not to have been able to find any farther account of the final event of this disease, and principally, whether the residuum of grumous blood was afterwards entirely dissipated.[*]

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[*] De Aneurysm. Hist. xv. En quomodo hæc observatio duas illas sustulit dubitationes, quæ meum animum devexabant; quum enim compressio, quam iliaca externa perpessa est, tanta fuerit, ut major fieri non posset ad inhibendum, ut ne vel minima sanguinis guttula per eamdem transiret, mihi tuto colligere datum fuit, sanguinem universum, a quo articulus nutrimentum susceperat, per internam tantum iliacam dilatum esse; quumque hoc aneurysma, etsi ab interna causa productum, pressionis beneficio fuerit sanatum, mihi evidenter innotuit; compressionem valere ad aneurysmata qualibet persananda, sive causa eadem progignens externa fuerit, sive fuerit interna.—Hæc autem adeo stabilis atque perfecta sanatio fuit, ut paucos post menses Morellus baculum pariter deposuerit, nullumque aliud in illo incommodum relictum præter exiguam claudicationem.

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[p] Loc. cit. Hist. xvii.

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[q] Duncan Med. Comment. Decade ii, vol. iii.

[r] In Schmucker's Vermischte Chirurgische Schriften 3. Band. pag. 327.

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[*] See Appendix, additional cases of inguinal aneurism, by Messrs. Abernethy, Freer, and Tomlinson. These cases point out a more certain and better mode of operation than that recommended by the author. *T.*

extremity, whenever the course of the blood is completely intercepted and suppressed through the *common* femoral artery. We cannot, therefore, without error, calculate from the natural and usual caliber of the collateral branches of these arteries of the pelvis, and of their anastomoses with those of the thigh in a sound state of the limb, how great will be their dilatation and power of transmitting the blood to the thigh, when, from the obstruction occasioned, for a long period of time, by the aneurism, these auxiliary arteries of the pelvis have acquired a size much greater than that which they commonly have. Besides this, I repeat it again, there is such a difference between an injection within dead vessels, and the circulation of the blood through the same living vessels, that we should not therefore infer from the first what ought to be the difficulty or facility of communication of the auxiliary vessels, and of the principal trunks of a part.[v] With regard also to the greater permeability of the lateral vessels of the pelvis of an aneurismatic limb, compared with the same vessels in a limb not affected with aneurism, we may consider Guattani's important case, *De inguinis, cruralisque art. aneurysm. hist.* xvi. In a man about 30 years of age, says he, dying of an inguinal aneurism, occasioned by a rupture of the femoral artery above the crural arch, or an inch below the origin of the internal iliac, who was carried off by the acuteness of the pains, and the violent fever brought on by the vast quantity of blood effused into the lumbar region and along the thigh, without gangrene, however, of the leg and foot, although the rupture of the femoral artery above the crural arch was of more than two months standing. On making an incision into the femoral artery in the body of this man, from the place of the rupture till where this artery acquires the name of popliteal, it was found to have gone on contracting more and more as it descended towards the ham, and in the vicinity of the ham it scarcely admitted a very small Anel's probe for the puncta lacrymalia. This same artery in the ham resumed its natural size. Having made a ligature on the femoral artery above and below the rupture in the abdomen, and injecting water by the common iliac artery, having first cut off the foot of the same side, it was observed, that the coloured water came out by the arteries which ramify round the articulation of the foot. Having tied the femoral artery in the thigh, in order to close the small passage which remained in it, the injection continued to issue out by the arteries of the foot as before. On tying together with this artery the popliteal also, the injection continued to flow out by the arteries of the amputated foot, but with difficulty, and in small quantity. From this case, it appears to me, may be deduced three very important corollaries. 1. That on the femoral artery being tied above the *profunda*, the internal iliac artery furnishes enough of blood for the preservation of the whole inferior extremity. 2. That on tying the femoral artery in the groin, or in the upper part of the thigh, that artery has a tendency to close spontaneously, and to be obliterated along the thigh as far as the ham. 3. That the femoral artery in the ham retains its natural size, from receiving at this place the principal currents of blood, which is conveyed from the internal iliac, and other anastomosing vessels, into the articular arteries of the knee, and from these into the trunk of the popliteal, provided this last artery is in a sound state at the points of communication with these articular arteries of the knee. We may add to all this, that Dr. Baillie also found, in the dead body of an adult man, the femoral artery obliterated above the *profunda*, without its having occasioned the loss of the circulation, or deprived the corresponding leg and foot of their life.

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[v] On this point, it is an object worthy of curiosity and admiration to observe the manner in which we succeed in making a frog inject a coloured substance into its sanguiferous system, of itself, or by means of the force of its heart and arteries. This is done by introducing gradually into the one or other of the auricles of the heart of this animal, by means of a small tube, a coloured fluid, such as spermaceti dissolved in cold water. The heart and arteries of the animal impel this injection into the finest vascular extremities of the viscera, and of the other parts, where it is undoubtedly not possible to make it pass by means of the same injection performed with a syringe in the dead body of the frog.

§ 14. Having therefore demonstrated by facts the possibility of preserving the circulation and life of the whole inferior extremity, notwithstanding of the obliteration of the femoral artery above the origin of the *profunda*, it seems to me a point on which there can no longer be any dispute, that in a case of aneurism situated so high in the groin, and so near to the crural arch, that it is indispensable to procure a steady obstruction of the common femoral artery, it would be better rather to tie the artery immediately above the origin of the *profunda*, or in the vicinity of the crural arch, than to entrust this very important part of the operation and cure to compression, although applied to the denuded artery, unless the destruction of the artery is so great and so close upon the crural arch, that a sufficient portion of artery does not remain without the crural arch to allow a ligature to be conveniently applied. In this case there would certainly be nothing else to be done than what was practised by Guattani with complete success in the person of Morelli; and this likewise in the supposition, that the coats of the ruptured artery were not in such a state of disorganization as not to be capable of *adhesive* inflammation. But if there be a sufficient tract of sound artery below the crural arch, on which the ligature can be applied, which the surgeon may infer from measuring the distance from the crural arch to the centre or lower third of the tumour, to which the fissure in the artery corresponds, he will proceed boldly to the operation, weighing well in his mind, however, that not being able to reckon on the co-operation of an assistant for suppressing the current of blood through the ruptured femoral artery, the whole depends upon his own intrepidity, knowledge, and dexterity of hand. Having therefore prepared the usual apparatus for aneurism, and placed the patient as has been already mentioned, the surgeon will plunge a straight bistoury into the lower part of the tumour, and with a firm and quick stroke will divide the aneurismal sac in its whole length, and likewise lay bare the crural arch. The clots will rush out, and the jet of fluid blood will be violent and dreadful; but, without losing a moment of time, the surgeon will introduce the fore-finger and thumb of his left hand through the clots and fluid blood, and proceed directly to lay hold of the trunk of the femoral artery immediately above the place of the rupture, and consequently stop the impetuosity of the hemorrhage. He will accomplish this with so much the less difficulty, the more the artery at the bottom of the aneurismal sac is found, to say so, insulated, as Severinus found to his great astonishment, and has pointed out to others;[1] and the more that the anterior crural nerve is separated the artery on the outer side, behind the external in of the psoas muscle;[y] the principal ramifica- of this nerve are all inclined towards the crest of lium, so that the femoral artery is properly co- l only by the large femoral vein. The surgeon holding the artery firmly compressed, immediate- ove the rupture, and laying aside his knife, will a spatula endeavour to separate the vein from the y for a small space, in order that he may be able ss between them and behind the artery the eyed e carrying a waxed ligature two lines in breadth. ssistant will draw out the ligature from the needle, nake a simple knot with it, while the surgeon, his right hand, will place a roll of linen between rtery and the knot. The assistant will then draw not, and tie the *common* femoral artery. The on being now at full liberty to use both hands, pply the second ligature below the rupture, rais- he artery by means of a large probe or a female ter, it being a matter of no moment whether the re includes the *profunda* together with the *su- ial* femoral artery or not. The dressing and quent treatment of the wound will be quite the with that which has been already detailed.

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[1] § 8 of this chapter.

15. The whole of this important subject of the rism at the top of the thigh will be very much il- ited by the reflections which will be suggested, as roceed, by the following case,[z] published by M. hamps. Albert Brondex, a man of letters, 60 of age, of a serous rather than a sanguineous con- ion, came into the hospital of la Charité the 10

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ischer. tab. nerv. extrem. infer. tab. iii, iv, fig. 1.

lecüeil Period. de la Societé de Med. de Paris, tom. v, N.

Vendémiaire, year vii (2ᵈ Oct. 1797). He had a circumscribed tumour at the top of his left thigh, nearly seventeen inches in circumference, which extended as far as the bend of the thigh, and only left the breadth of a finger between it and the crural arch. This tumour was instantly recognized to be a *true* aneurism, as it had all the characters of one. This disease had appeared six months before, under the form of a small tubercle situated in the course of the femoral artery, five fingers-breadth below the bend of the thigh. The fourth day after the patient's admission into the hospital, the tumour continuing to make progress, I assembled, says Deschamps, nine surgeons in consultation, Allen, Brasdor, Boyer, Corvisard, Culorier, Marignes, Pelletan, Percy, Thouret. After the examination of the patient, I proposed that the ligature of the femoral artery should be made below the aneurismal sac, pointing out how difficult it would be to compress the artery above the tumour in a secure and steady manner during the whole time of the operation, as likewise to be able to extend the incision of the tumour so high, and so near to the place of compression, as would be necessary for laying bare the artery conveniently, and to allow a ligature to pass between two arterial canals, of so great importance, and so near to one another, as the *superficial* and *profunda* femoral arteries. The dangers of a considerable loss of blood in a patient already very weak, and sixty years old, were also represented. On account of these circumstances, I proposed the ligature of the artery to be performed below the aneurism, trusting that the blood stopped there would be coagulated within the aneurismal sac, and from thence upwards as far as the origin of the *profunda*. After an hour's discussion, on collecting the votes, three were in favour of the inci-

on of the aneurism, and six for the ligature of the
tery to be applied below the aneurism. Having pre-
ured the apparatus, I undertook the operation in pre-
nce of the above-named surgeons. I made an inci-
on about two inches and an half in length in the
urse of the femoral artery, below the tumour, and
wards the middle of the thigh. Having divided the
teguments and the aponeurosis of the fascia-lata, I
roposed to raise the sartorius muscle, which, as is
ell known, covers the femoral artery at that place.
searched for the femoral artery there for some time,
ut to no purpose. I prolonged the incision a little
ore upwards, and removing and separating the mus-
ular fibres towards the inside of the thigh, I followed
e course of the *great* adductor muscle, along which
e cord of vessels of the thigh runs. I again sought
r the artery in the situation which it usually occupies
aturally, but it was not possible to feel the slightest
ulsation produced by it. Several repeated the same
earch, and all without success. We adopted the ex-
edient of searching for the femoral artery elsewhere.
ne of the surgeons introduced his finger into the
ttom of the wound towards the site of the aneurism,
d he thought that he felt the artery towards the in-
r side of the thigh under the sartorius muscle. I
sulated this muscle, but this was likewise an useless
easure, and no pulsation appeared below the finger
whatever place it was applied. To observe the bot-
m of the wound with greater precision, it was pro-
sed to cut across the sartorius muscle. In spite of
y repugnance, I yielded to the proposal; but this
s likewise performed without any benefit. Finally,
e returned to our first idea, that is, that the artery
d not at all changed its position. A nervous fila-
ent which usually accompanies the femoral artery,

which I had divided to free the patient from the violent pain which he felt at the knee whenever this filament was touched, confirmed me in this opinion. I passed a needle below the place where we were persuaded the cord of femoral vessels was, and, for a greater security, I included in the noose a portion of the great adductor muscle. Having passed through the ligature, I raised its extremities, and applied my finger upon the parts included in the loop, to observe if the blood filled and distended the artery; but nothing of all this was observed. I notwithstanding drew the ligature tight, making use of the *presse-artère*, and above this ligature I placed another in *reserve*. The patient lost less than three ounces of blood during the whole operation. I then introduced a small dossil of lint into the bottom of the wound, and made the leg and foot be fomented by means of bags filled with warm sand. The patient, however, was very much enfeebled on account of the length of the operation, which had lasted nearly an hour, and on account of the acute pains occasioned by the distension and by the stretching during the repeated searching for the femoral artery. The progress of the tumour continued as before. On the fifteenth and sixteenth, the tumour had reached almost to the crural arch, and began to grow livid at the upper part, although the thigh and leg preserved their natural heat; and the thigh was not very painful, although a little swelled. On the sixteenth, a part of the dressing was removed, and the ligature was tightened, having become somewhat slack. On the seventeenth, every thing was as on the preceding day; the pulse, however, was frequent, small, and contracted. In the night between the seventeenth and eighteenth, the patient complained more than usual of pain in the thigh, and complained more particularly of a dull pain in the aneurism, the bulk of which did not cease to increase. I visited the patient at one o'clock in the morning, and I found there was a sensible infiltration along the outer side of the thigh, without any hardness. The aneurism still remained circumscribed. On the eighteenth, the fourth day after the operation, we examined the patient with all that attention which his situation required. The aneurism, as I said, had continued to increase; the pulsation in it was evident; the thigh and leg were swelled. All these circumstances proved in an evident manner that the ligature below the aneurism had not produced the effect for which it was applied. The appearance of the patient promised very little. The small, contracted, frequent pulse, and advanced age, together with all the other reasons which I have enumerated in speaking of the consultation, contraindicated a second operation, which, however, the critical circumstances of the patient required to be performed, if we did not wish to abandon him to a certain and speedy death. The incision of the aneurism was decided upon, which was performed the same day, the eighteenth, four hours after mid-day, in presence of the surgeons Marignes and Valentin. A firm oblong compress was prepared, fixed to the extremity of a handle, that it might have the double advantage of occupying less room, and of being kept firmly in its situation upon the crural arch by a strong and intelligent assistant. Another assistant was placed near the first, to assist him, and supply his place, if it should be required. Having placed the compress on the femoral artery as it passes out from under the crural arch, I opened the tumour from its upper third downwards. The aneurismal sac, including the skin and the first lamellated layers, was more than a finger and an half in thickness. In the act of the incision a great quantity of fluid arterial blood issued out, together with a mass of clots about the size of the fist. The aneurismal sac when evacuated left a space greater than before between the point of compression and the upper angle of the incision; therefore, by means of this, I extended the incision upwards to the fingers of the assistant who compressed the artery, in order the better to discover the place of the rupture of the artery, which I had not been able to see distinctly through the blood which overflowed that cavity. Having done this, I introduced through the rupture of the femoral artery the end of a probe, in order to raise the artery as much as possible, and to tie it accurately; but the loss of blood obliged me to accelerate the application of the ligature. By the direction of the touch, and pressing the probe and the artery between my fingers, I passed the needle behind the artery, kept somewhat raised. I then drew the ends of the ligature upwards, and pressing the artery against the loop with my finger, the blood stopped. I placed a ligature of *reserve* above this ligature. I drew the artery tight with the interposition of the *presse-artère*, and applied a second ligature with a double knot below the sac, because the blood seemed to flow back from below upwards. After drawing these two ligatures, no more blood appeared in the aneurismal sac, which was filled with soft lint, and covered with a pledgit spread with liniment of arcæus. The *presse-artère*, which had remained in the first wound made at the middle of the thigh, was removed, as being of no use. The patient, in spite of the quickness of the operation, lost so great a quantity of blood, that he fell into a deadly faint, and expired about eight hours after. On the dissection of the body the following appearances presented themselves. 1st, The *profunda* femoral artery, which goes off from the *common* femoral artery in general at an inch and an half or two inches from the crural arch, arose in this subject from the *common* femoral at ten lines only from the crural arch. The *profunda*, as is usually observed, gave off the two circumflex arteries, which had in this subject a greater diameter than usual. The trunk of the *profunda* also was equal in diameter to that of the *superficial* femoral artery. The superior articular arteries of the knee were likewise evidently more than usually dilated. The *profunda* femoral artery adhered to the aneurismal sac in such a manner, that it was raised with the sac whenever the *superficial* femoral artery was raised by means of the point of the probe introduced into that artery; from which circumstance it was almost impossible to make the needle pass between the superficial femoral artery and the *profunda* without wounding the *profunda*, or at least without including both of these arteries in the ligature. 2dly, The ligature applied in the first operation comprehended along with the *superficial* femoral artery also the great femoral vein, and at the same time a portion of the fibres of the great adductor muscle. In the second operation, the upper ligature compressed the artery three lines above the aneurismal sac, and included besides a third of the whole circumference of the *profunda* femoral artery, so that this last artery had been perforated through and through by the needle. The ligature of reserve was found between the *profunda* and *superficial* femoral arteries. The lower ligature included the *superficial* femoral artery six lines below the aneurismal sac, where the femoral vein had been likewise transfixed by the needle. 3dly, The *superficial* femoral artery was found lacerated for the space of two inches, at the distance, however, of other two inches and eight lines from its origin, or from the crural arch downwards. The entrance and outlet of the aneurismal sac had the form of a funnel. The dilatation of the artery at the centre of the aneurism could not be estimated with precision, on account of this artery being confounded with the cellular substance which formed the greater part of the aneurismal sac. At an inch below the sac there was an enlargement on the posterior surface of the tube of the *superficial* femoral artery, that is, an incipient *true* aneurism, the internal surface of which was smooth, polished, and not at all changed. All the rest of the *superficial* femoral artery was in a sound and natural state. 4thly, The thigh was occupied by a purulent infiltration, which extended on the surface of the thigh, situated anteriorly and externally below the aponeurosis of the fascia-lata. There was no appearance of suppuration between the muscles lying in the vicinity of the first operation.'

§ 16. The greater number of surgeons only publish the histories of the successful cures, and draw a veil over the unsuccessful, from which, however, great benefit might be derived for the advancement of the art of surgery. The knowledge of facts, and the avoiding the errors committed by others, are, in my opinion, more useful than the mere precepts which are taught in the schools. M. Deschamps is one of the small number of those who have felt the force of this truth, and who are more anxious for the progress of surgery, and the good of mankind, than for empty fame. He, after the example of Hippocrates, has related ingenuously, both the good and bad success which he has had in the different modes of curing external aneurisms. On which account, he deserves great praise, as well as for his learning and skill in all the other branches of his profession. The history above related furnishes us with valuable ideas, and very important precepts, relative to the radical cure of the aneurism at the top of the thigh. It shews us, in the first place, that the ligature of the superficial femoral artery, applied below the aneurism, far from being a method conducive to the obliteration of the aneurismal sac, and of the artery above the tumour, contributes, on the contrary, greatly to accelerate the enlargement of it, and proves to us at the same time clearly, how great injury the compression may occasion, whenever the pressure falls below the rupture of the artery, or below the centre of the aneurism, from the difficulty of the situation, the size of the tumour, or from the carelessness of the patient, or surgeon. In the subject of the present case, the aneurism first appeared in the form of a small tubercle, situated in the course of the *superficial* femoral artery, at five fingers-breadth, or at least four inches below the crural arch. Now, if we were even to suppose, that the origin of the *profunda* femoral artery had been an inch and an half below the crural arch, it might from the very first have been boldly asserted, that the point of the rupture of the *superficial* femoral artery was two inches and an half below the origin of the *profunda*, a space sufficient to allow the ligature to be applied without including the origin of the profunda. But the dissection of the body shewed that this space was more than three inches in length; since it was found, that in this subject the *profunda* femoral artery arose from the *superficial* only ten lines below the crural arch. Although, therefore, after six months the aneurism had reached very high in the groin, and so far as to cover even the crural arch, it might have been with good grounds concluded, that there was enough of space for tying the *superficial* femoral artery below the origin of the *profunda*, and above the seat of the rupture. This was also rendered more probable, from observing, that notwithstanding of the very high degree of the disease before the operation, the leg and thigh were not swelled, and the circulation in these parts went on with sufficient freedom. I omit remarking, that in the first operation, which lasted nearly an hour, for discovering the femoral artery, this operation might have been very much shortened, and have saved the patient from the acute pains, if the operator, instead of making the incision towards the middle of the thigh, had made it higher up, and as near as possible to the upper part of the thigh, or where the femoral artery readily presents itself, and at very little depth, and where it is not covered or crossed by the sartorius muscle. And, with regard to the second operation, M. Deschamps divided the aneurism from the upper third of the tumour downwards, he therefore met with difficulties in laying conveniently bare the precise place of the rupture of the artery, and was obliged to return to the prolonging the incision, not only to the top of the tumour, but even as far as the hand of the person who made the compression on the crural arch. This, since it was necessary to do it, would have been much better done at first, and with less loss of blood, by dividing the tumour with one stroke of the bistoury, from the bottom as far as the crural arch. Further, if, in the case we are speaking of, the superficial femoral artery was raised with the point of the probe, and then the hemorrhagy suppressed by the operator pressing the artery between his fingers and the point of the probe, there can be no reason for accelerating the operation with such haste as to run the risk of wounding the *profunda* with the needle, or of including it in the same ligature along with the *superficial* femoral artery; both of which accidents happened. The ligature of large vessels ought never to be applied or tightened at random. It was almost impossible, says M. Deschamps, to avoid this accident, because the *profunda* femoral artery followed the aneurismal sac whenever the *superficial* femoral was raised with the point of the probe. In saying so, it appears that M. Deschamps had forgot, that after death he found the ligature of reserve placed precisely and accurately between the *superficial* femoral artery and the *profunda*; which proves, that, without precipitation, he might have been able to place the other ligature also between these two great vessels, without wounding either of them.[*] Farther, with regard to some other useful deductions which might be drawn from the examination of this case, I refer to what has been said in § 9 of this chapter.

§ 17. Re-assuming what has been said in this chapter with regard to the cure of the femoral aneurism, we may conclude, 1st, That the compression, if the integuments are entire, cannot be employed in any case of femoral aneurism, whether the aneurism occupies the lower part, the middle, or the top of the thigh. 2dly, That the aneurism of the lower part, middle, or top of the thigh, at the distance of about four inches from the crural arch, if it is *circumscribed*, may be radically cured by Mr. Hunter's method. 3dly, That when the aneurism is large and *diffuse*, and when, on account of the great distension produced by the effused blood in the surrounding parts, it threatens inflammation and gangrene, the best expedient is the incision of the aneurism, the quick evacuation of the clots and the ligature of the artery, above the laceration or wound of the artery. 4thly, That in the aneurism at the top of the thigh, in the vicinity of the crural arch, there may be a rule by which we may determine the place of the rupture of the artery, and consequently how great the tract of the *superficial* femoral artery is which may be tied below the origin of the *profunda*. 5thly, That when the rupture affects the *superficial* femoral artery so high up as to include the origin of the *profunda* also, so that the ligature of necessity falls upon the *common* femoral artery immediately below the crural arch, the surgeon ought not therefore, all the other circumstances being favourable, to despair of the success of the cure; since dissection and practical observations prove, that the arteries of the cavity of the pelvis may amply supply the circulation, and preserve the whole of the subjacent limb.

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[*] Loc. cit. Un peu plus haut (à huit lignes) du sac je passai la ligature d'attente précisement entre les artéres femorale, et profonde; parceque dans cet endroit la profonde n'etant point unie à la femorale, je pus saisir l'intervalle pour y passer l'aiguille.

CHAPTER XI.

OF THE CURE OF THE BRACHIAL ANEURISM.

§ 1. The aneurism of the arm, arising from a rupture or ulceration of the brachial artery, occasioned by a slow disorganization in some point of the proper coats of this artery, is, as we have remarked,[a] a very rare disease; while, on the other hand, the occurrence of aneurism is but too frequent in the bend of the arm, produced by the puncture of a lancet, or along the inner side of the arm and axilla, by a wound made by a pointed instrument, or by fire-arms. This circumstance is precisely the contrary of what we have seen happen in the lower extremity, in which, more commonly, the aneurism in the ham, of the lower part, middle, or top of the thigh, originates from a slow, *steatomatous*, *ulcerated*, *earthy* disorganization, or preternatural relaxation of a certain portion of the proper coats of the popliteal and femoral arteries; which indisposition, produced gradually by internal causes, on the supervening of any external violence, prepares and brings on in the artery, in one or sometimes more places, a total solution of continuity, and consequently an effusion of arterial blood into the cellular substance which surrounds the affected artery.

§ 2. If the brachial artery is unfortunately pricked in bleeding at the bend of the arm, it is very easy for·

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[a] See Chap. vii, § 12.

the surgeon to make the small wound of the integuments heal in a few hours, if it is placed and kept in contact by the usual means of compression. But, since the union does not take place equally in the subjacent divided coats of the artery, or does not take place between these and the posterior side of the vein, or with the cellular or other parts contiguous to the injured artery, so, for the most part, this accident occasions an effusion of arterial blood into the cellular substance surrounding the wounded brachial artery, from whence arises the aneurism in the bend of the arm. Genga[b] very judiciously remarks on this subject, that neither the stream of blood from the vein per saltum, nor the seeing that the blood which flows out is of a much more florid colour than before, are sufficient marks to warrant the assertion, that the brachial artery is wounded; since the flow of venous blood per saltum may depend upon the pulsations of the subjacent artery, which is situated very superficially, and almost immediately below the divided vein; as likewise, because in all venous hemorrhages, the blood, though black at first, is changed to a florid colour, as, on the first portion being discharged, the veins receive fresh blood from the corresponding arteries. To ascertain, by means of a certain and undoubted mark, says he, whether the blood comes from the vein or from the artery, place the point of the fore-finger at the distance of about a finger's-breadth below the wound, and make there a slight compression; for, if the vein has been wounded, the blood will stop, being prevented from ascending and circulating upwards towards the axilla; but if the artery shall have been wounded, the blood will not only flow as before, but with even greater impetuosity, not being allowed to run down through the compressed artery. When the brachial artery has actually been wounded, as the solution of continuity made in the proper coats of the artery by the point of a lancet is in general a very small wound, so, in most cases, the blood which issues out by it only produces at first a small pulsating tubercle, not painful, and without an evident change of colour in the skin covering it; and this tubercle remains sometimes stationary for a considerable time. But, in other cases, not long after the accident, the pulsating tumour increases; and it does so in proportion to the subsequent widening of the lips of the wound in the artery, according to the increased impetus of the arterial blood towards the injured part, and the diminution of the resistance which was at first opposed to the exit of the blood, by the cellular substance and ligamentous bands covering the wounded artery. In these circumstances, as soon as the extravasated blood has overcome the first barriers, it makes itself a way easily along the course of the humeral artery upwards, on the inner side of the humerus to the axilla, and the aneurism in the bend of the arm, from being *circumscribed*, becomes *diffused*; the whole arm becomes swelled, painful, and is placed of itself, to use the expression, in a state of flexion; the skin of the bend of the arm, and of the inside of the humerus, appears tense, shining, of a red-livid colour, and very painful; at last a fever attacks the patient; and in this state of the symptoms, if the patient is not quickly relieved, the great quantity of extravasated arterial blood rises so far as to fill the axilla, and then the subjacent hand and arm are soon after attacked by gangrene.

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[b] Anatomia Chirurgica, p. 208.

§ 3. The aneurism occasioned by a wound of the humeral artery, along the inner side of the humerus, by a stab of a sword, knife, or bayonet, forms more quickly than the aneurism occasioned by the small puncture of a lancet in the bend of the arm, and the former acquires a greater size in a much shorter time than the latter. From what has been said, this happens not only in the first case, on account of the size of the wounding instrument, but likewise on account of the flaccidity and easily distending nature of the cellular substance which surrounds the humeral artery, along the inner side of the humerus, as far as the axilla; which artery, on the other hand, in the bend of the arm, is covered and strengthened by a firm aponeurotic expansion. The wounds of the humeral artery, inflicted by fire-arms, do not, for the most part, give rise to aneurism immediately after the accident, but rather some days after, that is, on the falling off of the eschar produced by the violence of the injury done to the proper coats of the artery, and to the parts surrounding it. All these circumstances, however, ought not to be regarded as absolutely proper, and peculiar to the brachial aneurism in the bend of the arm, or along the inside of the humerus, in consequence of a wound. For the same phenomena may be also met with in aneurism of the inferior extremities, whenever this disease is produced by a wound of the popliteal or femoral artery, inflicted by a pointed or cutting instrument, or by a musket-ball.

§ 4. The aneurism in the bend of the arm, occasioned by the puncture of a lancet, may be radically cured by *compression*, as long as it is just beginning, and only forms a small, pulsating, *circumscribed* tubercle, without inflammation of the skin covering it, and when it is little or not at all painful; and when it occurs in young persons, in children, slender women, and in persons much emaciated, in whom the brachial artery a little above the bend of the arm is nearly superficial, and resting upon the bone of the humerus, in the vicinity of its internal condyle. Numerous examples of completely radical cures of this disease may be found recorded in almost every book of surgery, from the time of Galen to the present day. One of the most celebrated cures of brachial aneurism is that which the Parisian physician, M. Bourdelot,[c] effected in himself, by means of compression. In the very interesting history of the cure of this disease, obtained by Galen,[d] by means of the compression, it seemed to me to be a thing truly worthy of remark, that among the parts composing the compressing apparatus, he made use of a sponge, in order, as it appears, to keep up an equable and steady pressure on the aneurism. I do not find among the moderns, and not even immediately after Galen, any surgeon who employed the sponge, if we except, in the present day, Mr. White,[e] in those cases only in which the sponge may be applied to the wound of the denuded artery, with the view of stopping the hemorrhage. The moderns indeed direct, that we ought to apply upon the aneurism to be compressed, chewed paper, touchwood, or agaric; but it remains still to be ascertained, whether these substances produce the same good effects as are obtained by the sponge frequently moistened, in the case of which we are treating, where a constant and equable compression is necessary, without running any risk of causing the parts compressed to mortify. *Vidimus enim*, Galen writes, *in mulieribus, et pueris, tum conglutinatas arterias, tum carne undique circumdatas, idque in fronte, maleolo et articulo brachii, summæque manus medio. Simile quiddam aliquando in agresti contigit juveni, dum sanguinem sibi mittendi veris tempore curat, quod nostratibus maxime est in usu. Cum enim medicus qui venam incisurus erat brachium hominis deligasset, contigit attolli veluti in gibbum arteriam; itaque hanc pro vena medicus divisit. Exigua sane incisio erat. Sanguis autem flavus, et tenuis, et fervidus statim ejaculabatur, idque cum quodam veluti saltu. Ac medicus quidem, ut erat admodum juvenis et operum artis parum peritus, venam se incidisse putabat. Ego vero cum quodam alio ex iis qui aderant medicis utique seniore, ubi quod acciderat adverti, præparato ex emplastrorum genere quod sanguinem supprimit medicamento, tum incisionem curiose conjunxi, tum super medicamen illico imposui, ac spongiam mollissimam extrinsicus super hoc deligavi. Mirante vero qui hanc arteriam inciderat insolitam nostram in hoc casu providentiam, indicavimus homini rem factam, et postea quam incisi hominis diversorium exiissemus, jussimusque ne vel solveret nobis absentibus, vel ante quartum diem id aggrederetur, sed ita ut erat deligatum haberet, spongiam duntaxat desuper madefaciens. Postea vero quam in quarto solventes plane conglutinatam incisuram invenimus, rursus idem medicamentum imponere jussimus, tum simili modo deligare, nec multis postea diebus solvere. Atque ita percurata est hujus hominis incisa arteria, sola omnium, quas in cubito incisas vidi. Nam reliquis omnibus aneurysma, aliis majus, aliis minus supervenit.*

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[c] Blegny. Zodiac med. Gallic, t. 11. Martii, p. 43.

[d] Method. Med. lib. v, cap. 7.

[e] On the topical application of the sponge in the stoppage of hemorrhages.

§ 5. If Galen, in his extensive practice, did not obtain the same fortunate success in other cases of aneurism in the bend of the arm, from the wound of a lancet, that might perhaps be ascribed to his not having been present at the time of the accident, as he was in the case above related. For we must allow, that if the opportunity of curing this disease at its beginning be lost, the difficulties are every instant increasing, which may oppose the obliteration of the artery, and consequently the radical cure of the aneurism in the bend of the arm, by means of compression. With regard to this compression, and the manner of employing it, surgeons agree, that the preference ought to be given to that which, beginning from the fingers, extends gradually to the axilla. This is commonly called, in the medical schools, Theden's bandage; when in fact, and for the honour of the Italian school, it ought to be called the bandage of Genga. And, that there may be no doubt about this, and to explain the fact with the greatest possible clearness, I shall here describe this bandage in the author's own words.[f] 'In the month of May 1673,' says Genga, 'the artery was wounded in bleeding, in one efanassi, a man 60 years of age, of a sanguineous temperament. I immediately prepared, as well as the shortness of the time permitted, the proper dressings. applied to all the fingers, with small rollers, an expulsive bandage to each finger, and then, with a long roller, about three fingers-breadth, I began in the same manner to bandage the hand, ascending as far as the place of the wound, over which I applied a thick compress made of fine linen, moistened in an astringent composition made of terra sigillata, armenian bole, dragon's blood, bloodstone and gypsum, all mixed together with the white of an egg and plantain water, and I then placed over it a thick plate of lead, somewhat larger than the coin called *testone*,[t] and applying over it a few more compresses, I made three or four turns with the same roller, somewhat tight, over the place of the injury, and still more so above the elbow. Having done this, I applied on the inside of the humerus, from the place a little below the axilla, and a little higher than the internal apophysis of the humerus, a round piece of wood as thick as the finger, about half a hand's-breadth in length, rolled up in linen, like the splints which are used in fractures, in order that the veins and arteries which pass at this place being compressed by it, (which compression is better performed, the bit of wood being round, and not flat), the free and impetuous current of blood to the wounded artery might be prevented; this piece of wood was fixed by sewing it to the compresses and bandages, and supporting it with a firm roller. I again began to pass over all the already-mentioned bandages another roller, likewise expulsive, beginning and following an inverse order, the better to fix the first bandage, and I placed the arm, making the elbow form an obtuse angle. I farther ordered, that these bandages should be from time to time moistened with a liquor made of plantain water and rose vinegar, to which I made likewise be added the juice of plantain, evergreen, and the tops of bramble, extracted by expression from these simples, with the addition of a number of bruised green cypress nuts. Towards evening blood was drawn from his left arm, which was repeated several times in the course of the cure. The diet prescribed was very thin and cooling, particular attention being paid however to the strength of the patient, who bore the whole very well, being of a robust habit; and indeed, such was the spareness of his diet, that it was sufficient rather to hinder him from dying, than to make him live comfortably. I continued, without ever taking off the bandage, the use only of the vinegar and water, with the above-mentioned juices, bathing the bandages until a week was elapsed, not so much to keep the part cool, as to preserve the bandages tight, as they usually slacken easily. Having resolved to uncover the wound on the morning of the eighth day, on removing the bandages the wound in the skin was found completely agglutinated; but on the artery remaining for some time without the constriction, there was observed at the place of the wound some greater beating, and a little elevation; on which account, that the artery might not again be filled, and pour out blood under the skin, I immediately returned to the use of the bandage and former dressing, and it was not again uncovered for fourteen days more; after which, on removing the bandage, and leaving the limb without any tight bandaging for some little time, the artery was not observed to make any considerable motion. With all this care to secure still more from any unhappy accident, and to be very cautious, and not lose the advantage which had been gained, I again renewed the usual bandages and dressing, and continued the position, and the bandages were not removed till the twenty-second day; on which day, removing all the bandages, the arm was left at liberty, recommending to the patient not to use the part much, especially in violent motions; and thus the cure was finished; after which Cesanassi lived till the summer of 1684, when he died of a different disease.'

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[f] Anatomia Chirurgica, p. 219.

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[t] An Italian coin, nearly as large as a halfcrown piece.

§ 6. The description given by Genga of this bandage is a model of precision and perspicuity, worthy of imitation in similar matters. I wish, however, that young surgeons should be informed, that, whether it be immediately after the accident of the wound of the brachial artery, or even after the aneurism has begun to form, it is always a proper and useful rule, before applying the bandage of Genga, and during the time employed in applying it, to make the brachial artery be compressed by a skilful assistant above the clavicle, against the first rib; for this facilitates very much, in the act of applying the compression, the bringing the two opposite sides of the wounded artery into mutual and firm contact, and the keeping them so afterwards, in order to obtain in the sequel the cohesion and obliteration of the wounded artery. M. Desault, in a case of aneurism in the bend of the arm, employed with success a particular kind of bandage and compression of his own, which deserves likewise to be mentioned here.[h] He placed a hard and firm cushion as a point of support along the elbow, or a splint made of lath or wood, furnished with a small cushion, so that the point and sides of the elbow were included as it were in a semi-canal. Upon the wound of the artery, or on the incipient aneurism in the bend of the arm, he applied graduated compresses, which he secured by a figure-of-eight bandage, similar to what is used in bleeding; in such a manner, however, that the whole bend of the arm was covered by it. By the precaution of using this cushion and semi-canal, including the point and sides of the elbow, the principal point of compression falls upon the centre of the aneurism, or upon the wound of the artery which we wish to obliterate, without the bandage retarding in any degree the current of the blood through the lateral vessels, and still less hindering the return of the blood by the superficial and deep veins of the arm. If we wished to employ this kind of bandage, it would be useful, I think, previous to the compression of the axillary artery above the clavicle, to apply the bandage of Genga from the fingers to the bend of the arm, then to place the semi-canal of Desault, and a cylinder of linen along the brachial artery, as far as the axilla, and after making as many circles round the bend of the elbow as to cover it, to continue the bandage, ascending along the humerus upon the cylinder, as far as the axilla and scapula; in which manner, the advantages of the two above described methods of Genga and Desault would be combined in one.

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[h] See Appendix, note, No. 15.

§ 7. We soon learn from the first trials, whether the compression will succeed or not as a radical method of cure of the aneurism in the bend of the arm. For if, during the two first days, the patient cannot bear the bandage, and if the tumour below it, instead of diminishing, increases, is raised and spreads, if pain is excited in the tumour, and the skin covering it threatens to inflame, we cannot depend upon the bandage as a method of cure. La Faye[1] pretended, that the compression ought to be tried in every case of aneurism in the bend of the arm, whether the aneurism was recent and *circumscribed*, or of long standing and *diffuse*, in order, if not to cure it, at least, as he thought, to dispose the collateral anastomosing vessels to enlarge, and so prepare them to carry on the circulation, and preserve the life of the subjacent arm and hand, immediately after the ligature of the wounded brachial artery. This doctrine has likewise been published by some surgeons, on the subject of popliteal and femoral aneurisms; but experience has shewn, that these fears and anxieties of the surgeons of former times, with regard to the power of the collateral anastomosing vessels, in supplying the want of the principal arterial trunk, were ill founded, and that consequently, whenever the compression of the aneurism in the bend of the arm is contraindicated by the size of the tumour, by the thickness of the coats of the sac, by the pain and redness of the skin, by the tumour being *diffused*, the employment of the compressive bandage does great harm on all these accounts, and sometimes makes us lose the opportunity of obtaining those advantages which are constantly derived, in similar cases, from effectual practice, employed in time.[k]

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[1] Dionis. Cours d'operations, not. p. 695.

§ 8. If, fortunately, from symptoms quite opposite to the above mentioned, there is reason to hope that the compression is likely to prove useful, the surgeon ought to be very careful to moderate the impetus of the circulation by means of evacuations of blood proportioned to the constitution of the patient, and by a very strict diet; that the bandage continue to press equably, and that it be gradually increased in force, to such a degree, as not only to make the tumour disappear by degrees, but likewise to compress the artery sufficiently to excite the *adhesive* inflammation in the proper coats of the artery, and therefore that it be capable of producing the obliteration of the artery for a certain space above and below the injury. And, even when the surgeon shall believe that he has effected his, it will be proper that the patient do not leave off he bandage for several months after, and that he be upon his guard never to make any violent motions with the arm which has been wounded. For it has repeatedly happened, that the surgeon and patient, contenting themselves with observing that the aneurism in the bend of the arm has been reduced in a short time to the size of a small knot, not pulsating nor painful, by means of the compression, have left off the use of the bandage, and the disease, not long after the supposed complete and *radical* cure, has been renewed, on a violent exertion of the arm.[1] This misfortune is to be ascribed to the degree of compression, and of the *adhesive* inflammation having been ble to make the artery contract an adhesion with the cellular substance and the ligamentous bands surrounding it, and to convert the small aneurismal sac into a firm, thick knot, so that the bloody lamellated coagulum contained in the sac was kept firmly applied to the lips of the wound of the artery, and closed it in the manner of a plug; but the degree of pressure made by the bandage has not been sufficient to press the artery against the lower extremity of the humerus, so strongly as to obliterate the wounded artery, and convert it into a ligament for some space above and below the injury. An example of this occurred to me in the person of Antonio Gallina of Albuzzano, a countryman, 23 years of age, of a very slender habit of body, who having been attacked by inflammation of the chest, was bled in the left arm, on which occasion the artery was punctured. The incision of the integuments closed immediately by means of a tight bandage, and it was not till after he was cured of the peripneumony, that the patient complained of a tumour as big as a small nut in the bend of the left arm, precisely at the place where he had been bled. The tumour pulsated strongly, and had all the characters of a circumscribed aneurism. I ordered the patient to be transferred into the school of practical surgery. As he was very much debilitated, and the aneurism small, yielding, and not at all painful, I undertook the cure by means of the compression, in the manner described by Genga, on the 8th of February 1793. The cure went on so well, that towards the middle of April of the same year there remained of the whole tumour only a small tubercle, as large as two peas, which did not at all incommode the patient, and did not prevent him making freely the motions of flexion, extension, and rotation of the fore-arm; on which account, notwithstanding my remonstrances, he wished to leave the hospital, and resume his usual labours in the country. On the 30th November of the same year, this patient most unfortunately received a blow with a stick on the inner side of the left arm, which in a few days occasioned an abscess all round the elbow and bend of the arm. The patient was placed under the care of our skilful surgeon M. Volpi, who was not informed of any of the preceding circumstances of the case. The abscess was opened by an incision, exactly at the place which had been previously occupied by the aneurism. A great quantity of matter was discharged; there then appeared at the bottom of the wound a small bloody clot, on the removal of which, the arterial blood issued out with great impetuosity. From a complication of other very severe circumstances, depending upon the general and local state of the patient, I was of opinion, as well as M. Volpi, that amputation was indispensable. On examining afterwards the amputated arm, I immediately discovered the wound which had been made in the brachial artery by the point of the lancet; it was about a line in extent, and although several months had elapsed since the accident, it had the appearance of a recent wound. The brachial artery had preserved its natural diameter at the place of the injury, and the apparently radical cure consisted therefore in nothing more than the closing of the wound of the artery, by means of the application of the coagulated clot opposite to the lips of the small wound of the brachial artery. A case similar to this, but much more singular in relation to the time at which the disease was renewed, is related by Saviard.[m] There appeared, says he, in a man, after an evacuation of blood, an aneurism in the bend of the arm as large as a nut. He had this aneurism for sixteen years, without having been prevented by it from following his trade, which was that of a collier. On a sudden the aneurism increased to such a height, as to occasion so great a swelling in his arm, that it was almost becoming gangrenous. The operation was performed in this man; and it was found, that the coagulated bloody clot, which had been for so long a time adhering to the lips of the wound of the artery, had been detached from it for a small space. Of these facts of apparent cure of aneurism in the bend of the arm, in consequence of compression, Foubert[a] has recorded several others, which he had very carefully observed. ‘ In the year 1732, (says he), I was called six leagues from Paris to visit a man 70 years of age, who had been wounded in the artery by a country surgeon. The blood had been stopped by means of compresses, a plate of lead, and a very tight bandage, which I loosened, as the arm threatened to gangrene; and instead of the bandage, after having conveyed the patient to Paris, I contented myself with substituting a less firm compression. Seven or eight days after, on examining the bend of the arm, I found there a small aneurism as large as a walnut. I then applied a more accurate compression than before, by means of chewed paper, graduated compresses, a bandage, and a machine, differing from that denominated *ponton* in this, that it only compressed the tumour, and left the vessels which carry back the blood at liberty. No swelling supervened, and the pulse was soon after perceptible. Eight days after I renewed

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[k] Molinelli, speaking of an aneurism in the bend of the arm, which was of two months standing, very judiciously observes: 'Compressionem antea nullam adhibuerat ad continendum tumorem, neque ut in posterum adhiberet auctor fui. Nam qui mediocriter, et brevi comprimentes tumorem digitos, quod sæpe expertus essem, non ferebat, cum adduci non poteram, ut crederem, validiorem compressionem, et multo magis diuturnam esse laturum. Præter quam quod in ea, de qua modo mentionem feci, membranarum duritie, atque renisu, quem illa fructum tandem habitura esset non videbam, etiam si ferre potuisset.' Comment. Acad. Bonon. t. ii.

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[1] Flajani. Collezione d'Osserv. e Rifless. di Chirurg. t. ii, oss. xv, 10,

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[m] Journal des Savans, an. 1691. Il y avoit un corps etranger, qui étoit colé sur l'artére, et que le sang artériel s'echapoit par un petit endroit qui ètoit detaché depuis peu, et qui avoit causé tout le désordre. Au reste ce corps etranger n'étoit aucune chose qu'un sang fibreux et coagulé, revetû d'une membrane du coté qui ne regardoit point l'artére, et du coté qui la regardoit il s'étoit formé une petite enfonçure en forme de voûte.

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[a] Mém. de l'Acad. R. de Chirurgie, t. vi, in 8vo, p. 251.

the dressing, and I found no longer any mark of the tumour. In forty days the patient seemed to be cured, and I permitted him to make a moderate use of his arm. Some months after, this patient was struck with an apoplexy, and died. I obtained permission to examine his arm. I removed the cord of vessels from their situation, four fingers above and below the place where the artery had been wounded; and in separating the artery from the other vessels, I observed a small knot which corresponded to the place of the cicatrix, and which seemed to be formed by a firm cohesion having taken place between the aponeurosis of the biceps muscle, the cellular capsule of the artery, and the lips of the wound of the artery, as they were all glued together. Having opened the artery on the posterior part, or opposite to the place of the wound, a round hole was found at the place of the puncture, which corresponded to the small knot; which hole was closed up by a small indurated clot of blood; and this clot, like the head of a nail, appeared to keep these parts united together, and formed the cicatrix.' 'It is probable,' the author adds, following the opinion of M. Petit, 'that the cure of these diseases always takes place in the same manner, and that consequently the compression, continued for a long time, may cure this kind of wound.' Foubert then proceeds to relate a second fact, to the following purport. 'In the year 1748, I visited a man upwards of seventy-five years of age, who had been bled on account of a retention of urine; he begged me to loosen the bandage, for the surgeon, after having bled him, had tied his arm very tight, as he had found great difficulty in stopping the blood. On examining the arm (says Foubert), I found it very much swelled from the place of the bleeding as far as the axilla.

Having sent for the surgeon, he owned to me that the artery had been wounded. I removed the bandage entirely. I applied my thumb firmly upon the incision to press out the clotted blood interposed between the lips of the wound, and in the pit formed by my thumb I placed a piece of chewed paper, and over it graduated compresses, and then a roller. But there was notwithstanding a very considerable extravasation extending from the place of the bleeding as far as the axilla, which formed a projection in the direction of the brachial artery. I covered the humerus and the arm with compresses dipped in spirit of wine, in which there was dissolved some camphor and sal ammoniac. The pulse disappeared for some time. Eight or nine days after, I renewed the dressing, and had reason to be pleased with the state of the parts. There was no tumour at the place of the bleeding, but there was some ecchymosis around it. On re-applying the bandage, I only made that degree of pressure which I thought sufficient to complete the cure. The arm nevertheless remained swelled, and the effused blood formed an abscess. In fact, about three weeks after the accident, I was obliged to make an incision, from which there issued some black fetid blood. But all went on well at the place of the bleeding, when new symptoms, depending on the retention of urine, carried off the patient. I made the cord of vessels in the bend of the arm be removed from their situation, in order to examine what had taken place in relation to the wound of the artery. I found that the trunk of the brachial artery had been opened some lines above its division, that the opening was round, and filled with a clot of blood, which had become so hard as to allow us to hope that the patient would have obtained a complete cure, if he had not died from the violence of the other disease.'

§ 9. All these cases are far inferior to that which I shall now relate, both in relation to the methods of cure which were employed, and the singular manner in which I found the wound of the brachial artery, in consequence of a bleeding, closed in the dead body; from the subject of which I have taken figures 2, 3, 4, 5, of plate ii. The history of this case was communicated to me by Monteggia, a celebrated professor of surgery in Milan. 'A man, 76 years of age, feeling a numbness in his left arm, which made him dread an apoplexy, was bled in the left arm in the median basilic vein. The blood came with great force, velocity, and *per saltum*, and in fine could not be stopped, so that two other surgeons were sent for, as the first could not succeed in closing the vein; and it was at once ascertained that the artery had been wounded. At last, by means of small cushions, firmer compresses, and a tight bandage, the flow of blood was stopped. The part began to swell, with acute pain. The patient remained in bed. The day after, a particular swelling was observed, evidently pulsating in the bend of the arm, and the tight bandage was repeated, similar to that which is used in bleeding, but with more numerous turns. The third day, that is, the 21st March 1801, I was consulted (continues Monteggia) in this case, and found a very great swelling, extending over the whole limb, that is, over the whole arm, fore-arm, and hand. The bandage caused such insufferable pain, that it was necessary to remove it. The external wound of the bleeding was found to be sufficiently closed as not to pour out any more blood. The most elevated part of the swelling at the bend of the arm, for the extent of half a hand's-breadth in circumference, was felt not to be formed by blood infiltrated, as in the rest of the arm and fore-arm, but collected into a mass, fluid, undulating to the touch, and with a remarkable pulsation, and a kind of hissing noise, which terminated insensibly at the edges of this central collection of fluid blood. In this state it was my opinion, that the best practice was to adopt the method recommended by Mr. B. Bell and Mr. Latta, that is, to leave off all bandaging (as was indeed done), and to apply only a small compress, as in bleeding, with two or three turns of a soft roller, merely for affording a little support to the vein, that the subjacent aneurism might not fill it again, and this only for two days, when it was also left off. The arm was placed nearly extended upon a pillow, with the hand elevated. The great swelling would not allow it to be kept bent, not even in an half bent position. The whole limb was frequently fomented with cold vinegar and water. The pains abated as soon as the bandage was removed, and the day after, the swelling and tension were found already diminished, and even the pulsation in the centre of the tumour was sensibly abated; and this favourable beginning went on rapidly advancing during the succeeding days. On the twenty-ninth I substituted a fomentation of camphorated spirit of wine; but whether this was unseasonable, from there being some remains internally of inflammatory irritation in the wounded part, or from having placed the arm rather more bent than usual, not upon a pillow as before, but in a sling, or because some turn of the simply retaining bandage caused some constriction, from a displacement of some of the cloths of the fomentation; in four hours after, the patient began to feel rather acute pains in the arm, and the swelling and tension were much increased. The arm was therefore again placed on the pillow, fomenting it as before with vinegar and water, to which there was afterwards added only a little extract of lead, and the bandage was entirely removed, although it had been simply retaining and soft. The state of the arm immediately improved. A few days after, another slighter and transient exacerbation occurred, occasioned probably by some exertion; but, however, every thing went on well, and the man in forty days was perfectly cured of his aneurism, there remaining only a slight œdema of the arm and hand, which was treated with corroborants and the expulsive bandage. There remained merely a weakness and inflexibility of the fingers, caused probably by the long want of motion; from which affection, rendered perhaps more obstinate by the advanced age of the patient, it was impossible to relieve him. The pulse of the injured arm was equal to that of the other, and even at the greatest height of the aneurism was felt distinctly. In December 1802 this man was attacked by a catarrhal affection of his lungs and retention of urine, and died the 12th of the same month. In the body, on examining the arm, every thing was found in a natural state, except that on the posterior and external side of the humeral artery in the bend of the arm there was attached a dark-coloured body,[o] as large as a nut, enveloped and attached to the artery by means of the cellular substance.' Thus far the detail which I received from Monteggia. I afterwards proceeded to examine attentively the pathological preparation he transmitted to me. The brachial artery had preserved exactly its natural diameter;[p] and on opening it on the side opposite to the dark-coloured body, there was distinctly perceived on the inside of it the cicatrix[q] of the puncture which had been made in it by the lancet. On dividing this dark body vertically,[r] it appeared to be formed by a firm and large cellular capsule, although it was originally only a continuation of the soft cellular substance which surrounded the rest of the brachial artery. Within this hard rigid sac there was a clot of compact blood, nearly of a triangular figure.[s] One of the angles of this clot, of a whitish colour,[t] was formed rather by the fibrous substance than by the crassamentum of the blood. This angle insinuated itself into a fossa,[u] formed by the separated lips of the wound of the artery, which this clot closed up like a plug, and adhered firmly to the lips of it. Having removed all of this clot from thence, and introducing a probe into the bottom of this cavity, it was seen, and distinctly felt, that this small cavity corresponded exactly to the place of the cicatrix of the internal membrane of the artery.[v] The probe, even on using force, did not pass through the cicatrix into the tube of the artery. The bottom of this cavity[x] was hard and rough, and seemed to be hollowed out of a substance partly cartilaginous, partly earthy; and this circumstance was still more evident on passing the point of the knife over it.

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[o] Pl. ii, fig. 2, 3, *b*.

[p] ———————— *a a*.

§ 10. There can be no doubt that in this singular case there was not only, as in the preceding, the fibrous clot, which in the manner of a plug closed up the wound of the artery, but likewise that the lips of the wound, on the side of the cavity of the artery, were closed up by some kind of cicatrix. This cicatrix, if it may be called so, differed from the cicatrix of the simple wounds of other soft parts in this, that it was cemented, to use the expression, by an earthy substance, and that in this respect it had a greater analogy with the callus of the bones after a fracture, than with the re-union of the wounds of soft parts. In this particular case the artery had not been wounded anteriorly, but a little to the outer and posterior side; which circumstance may be ascribed to the custom which some surgeons have of pushing in the lancet nearly horizontally, and transversely, from the fallacious idea of avoiding, in this manner, the artery. It is wonderful how, in this case, on laying aside every kind of compression and bandage, nature was of itself capable of stopping the progress of the effusion of blood. And farther, it is not improbable, that the sudden and violent attack of *adhesive* inflammation contributed greatly to this, and that the situation also of the small puncture of the artery, a little external and posterior, far from having been disadvantageous, rather contributed, by means of the approximation of the parts surrounding the artery, to the more rapid cohesion of the cellular substance which formed the aneurismal sac with the lips of the wound of the artery, and thereby to the formation of the solid clot, which put a stop to the farther flow of blood. Finally, this particular case is no objection, as I have said in another place, to my considering the cure of the aneurism in the bend of the arm by compression, whenever there remains in that place a tubercle containing a clot of blood, however hard and coagulated it may be, as an imperfect cure, and therefore subject to relapse. The cure in this case of which we are speaking was not, strictly speaking, complete and truly *radical*, although there was in addition a kind of cicatrix on the side of the internal membrane of the artery; for the lips of the wound of the artery were still separated on the side of the small sac, and the cicatrix on the inside of the artery had without doubt changed for some way the natural flexibility of the proper coats of the artery; and this degree of rigidity had necessarily disposed the artery at that place to burst on the supervening of any violent internal or external cause. And though in this case, in which the compression could not be borne by the patient, and the disease was left entirely to nature, the event of it was favourable within certain limits, nevertheless, I believe that no one would allow himself to be induced by any of these rare successes to regard as a good general rule, that, whenever compression cannot be employed, he ought to wait, trusting too much to the powers of nature, rather than proceed without delay to the operation of the ligature of the wounded artery, which is a certain means of establishing a lasting cure, and much less formidable than surgeons commonly suppose. Farther, even before Foubert, in the year 1732, M. Petit[y] had presented to the Academy of Sciences the brachial artery of a man who had died suddenly two months after this artery had been punctured six lines above the place of its bifurcation. There adhered externally to the artery at the place of the puncture a small coagulated clot, which the author called the *couvercle*. Internally, within the tube of the artery, the clot or *couvercle* insinuated itself between the lips of the wound of the artery, without, however, protruding at all with-i the cavity of the wounded artery. M. Petit neverieless observed, that on pressing this clot exterilly, it passed through the lips of the wound into ie tube of the artery; which circumstance the author cpressed in fig. 3, annexed to his memoir. This obrvation differs a good deal from that which I have st related, and serves even to shew still farther, that iis means of cure of the wound of the artery is unertain and precarious, although Petit has endeavourl to prove that the coagulated *couvercle* is formed by substance analogous to that of a cicatrix. Besides, etit himself observes that this couvercle can never be means capable of stopping the hemorrhage, except i the case in which the wound of the artery is very nall, or, to speak more properly, a mere puncture; nce, if the incision of the artery were extensive, the npetus of the blood would constantly displace the *uvercle*, and the hemorrhage, or effusion into the celilar substance, would continue without intermission. he same objection may be made to the opinion of Araud, who thought that the great secret of the art of curig external aneurisms by means of compression, consted in finding a mode of forcing the coagulum of blood o go back by the orifice of the wounded artery, and o shut up this orifice after the manner of a plug. *lémoires de Chirurg.* vol. i, pag. 191. Such a meiod will never produce a cure truly *radical,* and exmpt from relapse, as facts have repeatedly proved.

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[q] Pl. ii, fig. 3, *c.*

[r] ——— 4, *c c.*

[s] ——— 5, *a a.*

[t] ——— 5, *b b.*

[u] Pl. ii, fig. 4, *d.*

[v] ——— 3, *c.*

[x] ——— 4, *d.*

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[y] Mém. de l'Acad. R. des Sciences de Paris, an. 1735.

§ 11. If the compression is inadmissible, because, though the aneurism in the bend of the arm be nall and *circumscribed,* it is foreseen that this method innot be employed in such a manner as to cause a total bliteration of the artery at the place of the injury; or ecause the rapid increase of the tumour, the excessive hardness of it, the acute pain which it occasions, the swelling of the arm, the symptoms of suppuration or gangrene require a speedy remedy, the surgeon will immediately proceed to the operation of the ligature of the brachial artery. This operation, as has been mentioned in speaking of the radical cure of the femoral aneurism, may be performed in two different ways; the one is that of M. Anel, or the ligature of the humeral artery above the seat of the aneurism, leaving the aneurismal sac quite untouched; the other by means of the incision of the aneurismal sac in the bend of the arm, and the ligature of the humeral artery in the bottom of the sac, above and below the place of the wound made by the lancet.

§ 12. The first, or Anel's method, deserves to be preferred to the second in those cases in which the aneurism in the bend of the arm is *circumscribed* and of moderate size, and not accompanied by violent inflammation and swelling of the whole arm, from the excessive distension caused by the clots of effused arterial blood, which is as much as to say, in circumstances nearly similar to those in which the compression may be tried. In the combination of circumstances contrary to this, or in the urgent symptoms now mentioned, which unfortunately is the most frequent case, and where the most pressing indication is that of removing quickly the excessive distension occasioned by the clots of extravasated blood, the second method, or the incision of the aneurismal sac, is to be preferred. Whenever Anel's method is indicated, it is to be performed in the following manner. Having placed the patient at the edge of the bed, with his arm separated from his breast, and firmly supported, the surgeon will press with the point of the finger immediately above the seat of the aneurism, and running upwards between the internal condyle of the humerus and the inner edge of the biceps muscle, he will search for the course of the humeral artery, which he will discover by its pulsations. He will have it in his option either to fix the place of the incision for laying bare the humeral artery immediately above the aneurism, or much higher, and in the long space between the origin of the *superior* and *inferior* collateral arteries. Having determined the most proper point for this, or where the humeral artery is found most superficial, he will divide the integuments in the course of this artery, and at the same time the cellular substance, for the space of about two inches and an half, and introducing the finger of his other hand into the bottom of the wound, he will feel the denuded humeral artery, and, if it is not sufficiently laid bare, will divide, with his hand unsupported, the parts which still cover it, observing to introduce the edge of the knife on the side next to the internal margin of the biceps, to avoid dividing any of the numerous muscular branches which go off from the opposite side of the humeral artery. He will then insulate with the point of the finger the trunk of the humeral artery alone if he can, or together with the median nerve and vein, and raise it a little from the bottom of the wound. He will separate the median nerve and the vein for a small space from the artery, and with the eyed needle he will pass behind the artery a waxed ligature two lines in breadth. Having allowed the artery to fall to the bottom of the wound, he will proceed with both hands to lay hold of the ligature, with which he will make a simple knot, and, before drawing it tight, an assistant will place the roll of linen between the artery and the knot. Having tightened the artery, the surgeon will examine the aneurism, and if the pulsations in it have ceased entirely, he will make a second knot over the first; he will clean the wound, will fill it with soft lint, cover it with a compress retained by a six-headed bandage, and place the operated arm in a convenient situation, in a state of semiflexion. The choice which the surgeon has of laying bare the humeral artery either immediately above the aneurism, or at the different points from the bend of the arm to the middle of the humerus, does not produce any change in the principal anastomoses of the humeral artery between the branches which go off above the ligature and the radial, ulnar, and interosseous recurrent arteries. For, notwithstanding the ligature be applied nearly at the middle of the humerus, the origins of the profunda humeral and *superior* collateral arteries remain entire, two very conspicuous canals, and sufficient to supply the circulation and life of the fore-arm and hand, although the course of the blood be interrupted through the principal trunk. This truth is proved by injections in the dead body, and confirmed in the living, by the case related by Anel, and by that related in the present day by Mirault.[z] Whoever, after these directions, shall have the treatment of a *circumscribed* aneurism in the bend of the arm, will no longer follow, I flatter myself, the method of those[a] who, supposing this tumour to be formed by the dilatation of the humeral artery, divided first the integuments over the tumour, insulated the sac, and sought for the humeral artery above and below the aneurism, in order to tie it in two places, and then endeavoured to make the sac mortify, and come away piece-meal, and be expelled from the wound in the same manner as the ligature. All this long and unnecessary process of operating, suggested by false ideas with regard to the nature of this disease, and of the parts which are affected by it, will be excluded for ever from good and rational surgery, and the operation reduced to the greatest simplicity, that is, to the ligature of the humeral artery above the aneurism, leaving it untouched, which will free the patient from the pains of a long unnecessary excoriation, from the necessity of a second ligature below the tumour, and from the unavoidable inconveniencies of a copious suppuration, which is required to facilitate the separation of the aneurismal sac from the bottom of the wound.

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[z] Chap. ix, § 5, 16.

[a] Chap. vii, § 2.

§ 13. The other method of operating, or that by the incision of the aneurismal sac, is performed in the manner I am now about to detail. Having brought the patient to the edge of the bed, so that the affected arm, removed from the side, rests upon a firm pillow, the surgeon will apply the tourniquet to the upper part of the humeral artery in the vicinity of the insertion of the pectoral muscle; or, when the whole arm is swelled and painful, he will cause the artery to be compressed by an assistant above the clavicle against the first rib. With a straight bistoury he will open the aneurism with one stroke from below upwards, passing at the same time through the integuments, ligamentous fasciæ, and aneurismal sac, observing that the incision pass through the middle of the cicatrix left by the lancet in the integuments. All this is to be done in the supposition that the aneurism forms a tumour sufficiently elevated. But supposing that the tumour was depressed, as in the recent *diffuse* aneurism, the surgeon will use a convex-edged bistoury, with which he will divide the parts cautiously, to such a depth that the bloody clot appears; then having introduced the finger of the other hand through the clot and within the tumour, along it he will divide the tumour in its whole length in the direction of the humeral artery. In the very act of dividing the aneurismal sac, the compressed mass of clotted blood will burst out, and will be followed by a jet of a portion of fluid blood. Having cleaned the bottom of the aneurismal sac with a soft sponge, the humeral artery immediately presents itself to the surgeon in the bottom of the sac, and at the same time the precise place where it has been opened by the lancet, especially if the aneurism, although *diffuse*, be elevated and pointed. Having then laid aside the knife, and taking in his right hand a large strong probe, he will introduce it through the wound made by the lancet within the tube of the artery from below upwards, and with it will raise up the artery, while with the point of the fore-finger of the left hand he will separate it from the flaccid cellular substance, which keeps it tied laterally and posteriorly to the neighbouring parts, and he will continue to do this till the point of the finger shall have passed behind the artery, which he will raise from the bottom of the sac alone, or along with the median nerve. If it is along with the median nerve, having drawn back the probe, he will separate gently with the fore-finger and thumb of his right hand the nerve from all that portion to which the ligature is to be applied. This separation of the nerve from the artery is easy, and often very readily performed, from the median nerve very frequently not adhering firmly to the humeral artery, or from the clots of blood having already caused a separation of it. Having separated the humeral artery from the nerve[b] for a small space, the surgeon will pass the eyed needle, armed with two waxed threads of convenient breadth, from the inner towards the outer side of the arm, behind the artery, still supported with the point of the fore-finger of his left hand; after this he will withdraw the fore-finger of his left hand, and will allow the artery to fall to the bottom of the sac. He will then proceed to make the ligature, that is, with one of the ligatures he will tie the artery a little above the place of the wound made with the lancet, and with the other he will do the same below the wound, making a simple knot, and interposing a cylinder of linen between the artery and the knot. After having done this, the surgeon will direct the pressure to be removed from above the clavicle, or the tourniquet to be loosened, and if no arterial blood appears, he will clean the cavity of the tumour, and finish the operation in the manner above described.

[b] I cannot comprehend why Mr. Sharp on this subject has observed, that the ligature of the median nerve along with the artery is an accident which can almost never be avoided, although those who have written on surgery recommend it to be avoided. Critical Inquiry, chap. vii.

No one can regard it as a matter of indifference, in the act of stopping the current of blood to the arm through the great artery, to deprive it also of the influence of one of its greatest nerves. And setting aside even this reflection, if it has been shewn that the security of the ligature of a great artery depends very much upon tying the artery denuded, the including of the median nerve cannot fail to oppose the success of the operation. Molinelli himself has not passed over in silence the inconveniencies of such a practice; for he writes: 'Nervo etiam ac vena rem ut celerius expedirem quam possem, simul cum arteria comprehensis. Qua ex re gravius paulo indoluit quam cum seorsim constringeretur arteria. Ac tum de amisso præsertim manus sensu motuque quæstus est. Hic avulsum sibi, sublatumque fuisse quidquid ejus artus infra vincturam erat conclamavit, negabat omnino se has partes habere amplius, quod antea non fecerat.' Loc. cit.

§ 14. It ought not to be concealed, that even the most ancient medical men knew,[c] that, in spite of the ligature of the trunk of the brachial artery, the circulation and life continued as before in the subjacent fore-arm and hand. Nor, after so ancient and well authenticated traditions, can I discover the reason why the surgeons who came afterwards, and almost to the present day, have never prepared to perform this operation but with great perplexity, and never without having at the same time the instruments for amputation in readiness. At present, in consequence of the diligent anatomical investigations with regard to the distribution and anastomosis of the vascular arterial system of the arm, the explanation of this phenomenon is no longer doubtful or obscure; and also, if the ligature of the brachial artery applied towards the middle of the arm leaves a free and easy passage to the blood by the *profunda* humeral artery, and by the *superior* collateral to the anastomoses of the flexure of the elbow, the ligature of the brachial artery, a little above where venesection is practised, renders this passage of the blood still more expeditious, on account of the channel opened by these two arteries, and at the same time by the *inferior* collateral artery. It is to be observed, however, that the beating of the radial artery is not immediately felt at the wrist in every case after the ligature of the brachial artery; for the pulse sometimes does not appear for some days after the operation; at first after the manner of a deep tremor, then of a weak, and at last of a strong and natural pulsation; which circumstance does not produce any sensible change in the vitality of the arm or hand. And this is an additional argument among the many others of this kind which may be adduced in order to prove, that, for the preservation of the circulation and ife of a part, it is not necessary that the arterial blood circulate in it in such quantity, and with such impeuosity, as to cause an evident pulsation of the arteries of the part which it supplies.

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[c] Ætius, Paulus.

§ 15. In the greater number of persons the brachial artery divides into radial and ulnar very near to the bend of the arm, or upon the lower end of the brachialis muscle. In some individuals, however, this division of the brachial artery takes place much higher up, that is, above the middle of the humerus, and sometimes in the axilla. Among the preparations of this anatomical cabinet there are two of this kind, in which the division of the brachial artery is seen as high up as the insertion of the great pectoral muscle. Laurent,[d] Bidloo,[e] Petsche,[f] Winglerius,[g] Schmidelius,[h] Heister,[i] Monro,[k] Hunter,[l] and Ludwig,[m] have described and delineated these various divisions of the brachial artery at different distances above the bend of the arm. In those subjects in which this division of the brachial artery occurs high up in the humerus, it is constantly observed that the radial and ulnar arteries descend along the inner side of the humerus near to one another, and that when they have reached the bend of the arm, one of them, the radial, is raised, and becomes unusually superficial precisely at the place where venesection is usually practised. This was perhaps the case of the young man of which Galen[a] made mention, when he said, *contigit atolli veluti in gibbum arteriam; itaque hanc pro vena medicus divisit.* In a case of wound or aneurism in the bend of the arm in a patient with such a conformation, where the radial and ulnar arteries run on the inside of the humerus, parallel and contiguous to each other, it might very readily happen that the surgeon, in performing the operation, would include both arteries in the ligature. The mistake, indeed, would not be of great consequence, since, according to all the calculations, the ligature of these two arteries in the bend of the arm, or even higher up, would not produce consequences different from those which the ligature of the single and principal trunk of the brachial artery produces above the division of the radial and ulnar arteries. For, in the former, as well as in the latter case, the passage of the blood would remain equally open by the *profunda* humeral and two collateral arteries to the anastomoses formed by the recurrent arteries of the elbow. However, we must allow, that it would render the operation more complete to avoid in similar cases the tying of both of these arteries, as it is only necessary to tie the one which has been wounded. And the surgeon will certainly avoid this inconvenience, if he will always proceed in the operation of which we are speaking according to the rules above laid down; that is, if, after having evacuated the clots, carefully cleaned the bottom of the aneurismal sac, and exposed the place where the artery has been wounded, he will introduce a probe into he tube of the injured artery, and raise it upon it, hile with the point of the fore-finger of the other and he endeavours to insulate it from the neighbouring parts, to separate it for a small space from the edian nerve and vein, and tie it carefully denuded bove and below the place of the wound.

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[d] Histor. Anatom. pag. 146.

[e] Observ. Chirurg. pag. 64.

[f] Sylog. Observ. Anatom. N. 54.

[g] Exposit. Anat. N. 143.

[h] Dissert. Epistol. de varietatibus vasorum, fig. 1.

[i] De Art. Cruralis vulnere Dissert. fig. 4. Comp. Anat. not. 66.

[k] Monro's Works, N. 14, plate ii, fig. 5.

[l] Medical Observ. and Inquiries.

[m] De variantibus arteriæ brachialis ramis progr. 1767.

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[a] See above, § 4.

§ 16. Whichever of these two methods of operating is employed, the subsequent treatment is the same s that which is practised after the ligature of the *uperficial* femoral artery. This consists chiefly in keeping the external lips of the ulcer gently separated, until the ligatures have come away, and till the bottom of the wound has risen nearly to a level with the integuments. If any of the ligatures is longer than usual of coming away, that is beyond the twentieth day, and if the loop is observed to be relaxed, it will be proper to pass a probe, or a fine conductor, within the loop, and upon it a pair of scissars, to divide the noose, and then to withdraw the threads of the ligature from the bottom of the wound. After the ligatures have come away, the surgeon or the assistants will pay particular attention to make the operated arm of the patient be extended and bent gently several times a-day, in order to prevent the rigidity of the joint of the elbow; an accident which ever fails to happen when this practice has been neglected beyond the fortieth day.

§ 17. The method of operating for the cure of the umeral aneurism, occasioned by a wound of a sword, nife, or bayonet, or of fire-arms, is perfectly simiar to that hitherto explained. This aneurism is generally *diffuse*, and therefore requires a method of ure no less efficacious than speedy to remove the excess of the distension of the integuments and interstices of the muscles, produced by the numerous clots of extravasated blood; which method of cure, for the reasons mentioned, can only be that of the incision of the aneurism, the evacuation of the bloody clots, the insulation and ligature of the denuded humeral artery above and below the place of the wound. Upon this point, after all that I have said in relation to the steps of the operation of the aneurism in the bend of the arm, by the incision of the sac, there remains nothing else to be added on the subject of the *diffuse* humeral aneurism, the operation being precisely the same in both cases. It is only proper to remark, that whenever the humeral aneurism, (and this may also be said of the femoral, or of any other external part of the body), has been produced by a wound inflicted laterally in the artery, it is not a matter of indifference to make the incision of the aneurism in one place rather than in another; for if unfortunately the brachial artery has been wounded, not perpendicularly and on the fore part, but laterally and a little posteriorly, and in such a manner that its posterior side has been considerably opened[*] by the wounding instrument, as by a sword, knife, or musket ball, it may happen that the surgeon, following the ordinary plan of making an incision into the aneurism anteriorly, and even after having laid the artery accurately bare, finds himself placed in the embarrassing situation of not being able to discover the precise place where the artery has been wounded, and consequently not to be able distinctly to ascertain where to lace the ligatures. And the difficulties are still furher increased, on this account, that the blood does ot flow out, at least *per saltum*, from the denuded rtery, which beats as in the sound state. This is ocasioned by the pressure which, at the moment when he arm is extended, the surrounding parts make gainst the wound of the artery, which prevents the ischarge of blood, and conceals from the eyes of the perator the exact place of the injury in the artery. The surgeon, then doubtful if it is really the trunk f the brachial artery which has been opened, or a arge branch of it, which he cannot ascertain, contents himself with filling the aneurismal sac with lint, and replacing the arm in a state of semiflexion. But no sooner are the dressings applied, than they are tinged with fresh blood. He renews the dressing, without having been more fortunate in discovering from whence so much blood comes. The hemorrhage recurs again epeatedly; the patient's strength is exhausted; and he surgeon, no wiser than he was at first, not to eave the patient to a certain death, resolves to ampuate the arm. This important point of practice will e illustrated by the following history.[t] 'A young an, 25 years of age, in the act of parrying a blow f a knife, was wounded in the arm. The knife enered by the outer edge of the biceps, and wounded he posterior part of the humeral artery. The arm welled prodigiously. The extravasated blood exended from the elbow to the axilla, and the fore-arm as covered with ecchymosis down to the wrist. M. eschamps undertook the cure of it some days after he accident, making an incision through the integuments and the aneurism, along the course of the humeral artery, for the space of five inches from the insertion of the deltoid muscle downwards; he then evacuated the clots of blood, and laid bare a considerable portion of the humeral artery. On suspending the compression, which an assistant made above the clavicle, the operator and assistants were very much surprised at not perceiving immediately the place where the humeral artery had been wounded, and more particularly at not seeing a drop of blood discharged from it, although it beat at every point like a sound and uninjured artery. After searching for a quarter of an hour, some thought that the humeral artery had actually been wounded, others not. It was resolved to pass round the humeral artery a waxed thread, to be drawn in case of the hemorrhage recurring; and in the meantime to apply a compressive apparatus to the denuded artery. To pass the waxed thread more conveniently round the humeral artery, M. Deschamps dilated the wound made by the knife, introduced his finger by it from below upwards, towards the axilla, and having reached a certain height, he passed the needle and thread round the artery, six lines higher up than the place to which the point of his finger had reached. The compression on the denuded artery was then applied, but so as not to suppress the pulse at all. The day after, at four in the morning, the blood burst out, but was stopped by a greater degree of pressure. The following day the hemorrhage reappeared, and was likewise suppressed by the same means. On the fourth day the loss of blood recurred with greater violence, and more alarming than before. At mid-day again a hemorrhage. The dressings were removed, in the hope of discovering at last the exact place from which the blood issued, but to no purpose.

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[*] I allude to a large wound, not to a small incision made laterally and posteriorly in the artery, such as the prick of a lancet, as in the case above related, § 9.

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[t] Deschamps. Obs. et Reflex. sur la ligature des principales arères blessées, Obs. 1.

M. Deschamps then tied the ligature. The instant that the knot was drawn, the blood gushed out and filled the cavity of the wound, and shewed that the ligature had been applied below the place where the humeral artery had been wounded. The operator immediately passed another thread behind the artery above the first, and tied it. The hemorrhage was immediately stopped, but it was too late; for the strength of the patient was already exhausted, he soon after lost all sensation, and expired. On examining the body, it was found that the humeral artery had been wounded obliquely and posteriorly, from the outer towards the inner side of the arm, for the space of two lines lengthways, and opposite to the lower edge of the great pectoral muscle; that the wound was above the origin of the superior *profundæ* humeral arteries; that the first ligature had been applied about four lines below the wound of the artery, and the second ligature about five lines above it.'

§ 18. It appears to me, that in the case just related, if the operator had deviated from the general rule, or, instead of making the incision of the bloody tumour on its anterior surface, following the course of the humeral artery, if he had enlarged the wound made by the knife, he might by this have succeeded in discovering the exact place where the humeral artery had been opened, and thereby have been able with certainty to apply the ligature above and below the place of the injury in that artery. What I here assert is self-evident. For if, in order to pass the first ligature, M. Deschamps had enlarged the wound made by the knife, introduced his finger from below upwards towards the axilla, made the ligature pass six lines above the point of his finger, since in the dead body it was found that this ligature was situated only four lines below the wound of the artery, it is evident, that if he had, along his finger, or on a conductor, continued to enlarge the wound for ten lines more upwards, he would have succeeded in discovering the place of the wound of the humeral artery, and might have applied a quick and sure remedy.* Farther, whether the loss of the arm would have been inevitable, on account of the humeral artery having been wounded so high in the axilla, as to be situated above the origin of the *profundæ* humeral arteries, (since there are sometimes two of these arteries), is a question different from the first, and shall now be examined separately.

§ 19. As experience has shewn, that, on the *common* femoral artery being tied, compressed, or in any other way obliterated, as it passes out below the crural arch, and above the origin of the *profunda*, the patient nevertheless preserves the whole of the corresponding inferior extremity, it may be asked, in like manner, if it is possible to obtain the same advantage for the preservation of the arm, whenever necessity requires the axillary artery to be tied above the origin of the *profunda*, or of the two *profundæ* humeral arteries? With regard to this point, anatomy in the first place shews us, that as the arteries of the cavity of the pelvis communicate repeatedly on the outside with the circumflex arteries, and with the *profunda* femoral, so those of the neck, and especially of the *inferior* thyroid, and those coming off from the trunk of the subclavian, winding round the scapula, communicate repeatedly with the inferior scapular, with the circumflex arteries of the humerus, and then with the *profunda* humeral below the origin of this artery. In Chapter IV, I entered expressly into very minute details relative to the anastomoses of the arteries of the neck, scapula, and top of the arm, and I employed the greatest possible attention, in order to render these anastomoses clear and distinct; from which it appears, that we may tie the axillary artery above the origin of the *profunda* humeral, with as much confidence as we tie the *common* femoral artery, above the origin of the *profunda*; that we may have even more confidence in the case of which we are speaking, considering that the anastomoses of the scapula and top of the humerus ought to yield more easily, to convey the blood from the neck, thorax and scapula, into the superior extremity, than those of the inside of the pelvis to the inferior extremity, if we reflect that the former are nearer to the heart, and to the centre of the impulse of the blood, than the latter. This truth resting upon dissection, is farther proved by the following practical observation. Mr. Hall, surgeon,[x] was called to a man living in Cheshire, who had received a wide and deep wound by a scythe in the cavity of the axilla, which had divided the axillary artery. The wounded person fainted from the great loss of blood, which contributed in a great measure to his safety, as he was at that time without any assistance. Mr. Hall was passing by accident in that neighbourhood, and had with him neither his instruments nor sewing needles. Notwithstanding this, as the laceration in the axilla made by the scythe was very wide, this surgeon took hold of the wounded artery with his fingers, exactly at the place where it had been divided, and kept it firm, until he could procure some thread, with which he tied it circularly. The man recovered, and retained the use of his arm, except that in that arm the pulse remained a little weak and tremulous.[y] There are likewise some examples of a large wound of the axillary artery being cured by nature, in cases where her beneficent operation was not prevented by a violent impetus of blood sent from the heart; that is to say, after a profuse hemorrhage. There is a very celebrated case related by Van-Swieten,[z] in which, although the arm remained emaciated and weak, it was not however deprived entirely of life, although all the circumstances of this accident lead us to suppose that the axillary artery had been contracted and obliterated, or that this artery had been obstructed by the presence of a coagulated clot, firmly adhering within the tube of the artery. Besides this, it is to be observed that the median nerve might have been much injured along with the artery, or some other nervous trunk of the arm, to which was to be ascribed, in part, the state of emaciation and debility in which the arm continued, rather than this accident should be considered as the effect only of the impeded course of the blood through the axillary into the brachial artery. It may perhaps be objected to this, that two great practitioners in surgery, Desault and Pelletan, have performed the ligature of the axillary artery without success; but on this subject it is necessary to mention,[a] that one of the patients died of hemorrhage during the operation, because the ligature of the axillary artery being tightened by chance, the artery was not included in it; and that the other patient died a few days after the operation, from gangrene of the whole arm, owing to the brachial nervous plexus being included along with the artery. And indeed, although sometimes in a case of aneurism in the bend of the arm, the median nerve has been tied, without any great injury, along with the humeral artery, I do not therefore believe that any one will be easily persuaded that the plexus of brachial nerves may be also tied, with impunity, along with the axillary artery; and still less, that the brachial plexus may be tied with a knot, without great risk, even for a few minutes only, as was done by Desault, until he had succeeded in securing the axillary artery. For, the tying the nerves tightly, even for a few minutes, is equivalent to cutting them; and they do not recover their activity, although the ligature be removed immediately after. I am so fully persuaded, by anatomy, that the arm may be saved, notwithstanding the ligature of the axillary artery, independent of the plexus of brachial nerves, that I venture to predict, that the time will come, and that ere long, in which surgeons will wonder at our doubts on this subject, as we have been astonished at the perplexity and fears of our predecessors on the point of the ligature of the brachial artery, so high up as the middle of the humerus, and of the femoral artery in the upper part of the thigh, or only at four fingers below the crural arch, without the subjacent limb being deprived of its circulation and life.[b]

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* With regard to this point, it appears to me, that, when the brachial artery is wounded on the outer side of the arm, instead of enlarging the wound and tying the artery as the author recommends, it would be better to operate in the following manner. Let a probe be introduced by the wound of the integuments, and an incision made upon it, on the inner side of the arm, along the course of the artery; at which place it lies quite superficial. If the wound in the artery is discovered, on the vessel being laid bare, it may be tied in the usual manner; but if the wound cannot be discovered, as frequently happens, let a ligature be then passed round the artery and tied. If this ligature is applied below the wound, the blood will immediately rush out, and will direct the surgeon where to apply a second ligature above the injury. If no blood is discharged on the ligature being tied, it will shew that the artery has been secured above the wound; and I conceive it to be a matter of little consequence, whether a second ligature be applied below the injury or not, as any hemorrhage which may occur would be easily restrained by a moderate degree of compression. *T.*

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[x] John Bell, Discourses on the Nature and Cure of Wounds, p. 59.

[y] See Appendix, Mr. Keate's case of axillary aneurism. *T.*

[z] See Appendix, note, No. 16.

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[a] Caillot. Essay sur l'Anéurisme, p. 84, 86.

§ 20. In the case of its being necessary to perform the ligature of the axillary artery, the surgeon will have it chiefly in his mind, that nothing will tend more to embarrass him in the execution of the operation, and prevent its success, than an ill-judged smallness of the first incision, that is, of the integuments of the axilla and of the other parts which cover it, and conceal the wound of the artery. Having therefore placed the patient on a table of a convenient height, with his arm removed as far as possible from his breast, and kept firm in that position, a skilful assistant will make the compression of the axillary artery above the clavicle, and opposite to the first rib. If the wounding instrument has passed from below upward, directly into the cavity of the axilla, the surgeon will dilate the wound freely upon a sound or conductor, or along his finger, and as high up as is sufficient for bringing into view a considerable portion of the axillary artery, and for shewing the exact place where it has been wounded. If the wounding instrument has run obliquely, or from above downwards, through a portion of the *great* pectoral muscle, and from thence into the cavity of the axilla, the surgeon will not hesitate a moment to divide across the lower edge of the *great* pectoral muscle, and upon the conductor or the point of his finger introduced into the wound, he will make a large incision, so as to discover clearly and distinctly the injured place of the axillary artery. The thoracic arteries, which shall be included in this incision, should be tied immediately, and after evacuating the clots of blood, and cleaning the bottom of the wound with a spunge, however great and extensive it may prove to be, the axillary artery, and the place where it has been wounded, will appear the better. As this artery in the axilla is imbedded in the cords of the brachial plexus,[c] so in order to draw it easily from this bed, the surgeon will lay hold of it denuded with the forceps at the place of the wound made in the artery, and will draw it towards him; after this, he will separate it from the soft cellular substance surrounding it, which is very easily done, having drawn the artery out a little from the one or other of the sheaths formed for it by the roots of the median nerve, with the eyed needle he will pass round it two waxed ligatures, with the first of which he will tighten the artery above the wound, and with the other below the wound, placing the roll of linen between the simple knot and the denuded artery. After this, he will clean the bottom of the wound, will fill it with soft lint, and cover it with a compress supported by a four-headed bandage crossed upon the shoulder; he will bring the arm close to the patient's breast, and conduct the rest of the cure in the manner repeatedly mentioned in the preceding chapters, both as to what regards the fomentations, and the means for drawing the blood down from the top of the scapula to the hand, and with regard to the treatment of the wound; principally attending to that part of the cure, which is intended for preventing the stagnation of the matter, and the formation of sinusses.

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[b] I wish to be understood as speaking of the injury of the axillary artery, not complicated with other severe accidents. For, whenever the great artery of a limb, especially in the vicinity of any joint, has been lacerated by a musket ball, by a severe blow, or the passage of a cart-wheel over it, and the injury is complicated with a great contusion of the muscles, and especially with a fracture of the bones, and great extravasation of blood, and general atony of the whole limb, I have invariably observed, that the ligature of the great artery of this limb, at whatever distance from its origin, is of no use, and that the amputation or disarticulation, timely performed, is the only means which can save the life of the patient.

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[c] Tabulæ neurologicæ. Tab. iii, U. U. 177—181.

§ 21. In speaking of the popliteal aneurism of long standing and of prodigious size,[d] accompanied with swelling, numbness, and coldness of the subjacent leg and foot, as well as with symptoms threatening an approaching rupture of the skin covering it, in a sickly and debilitated patient, it has been said that in this particular extreme case, neither the old nor the new method could be prastised with any hopes of success, and still less could much confidence be reposed in the amputation of the thigh; for which reasons I stated, that in similar distressing circumstances, the disarticulation of the leg at the knee, seemed to me to be preferable to any method we are at present acquainted with, premising the ligature of the *superficial* femoral artery in the upper part of the thigh. Similar very urgent circumstances may likewise present themselves in a case of large axillary aneurism, from a wound inflicted in that artery very high up in the cavity of the axilla; and from this wound being complicated with a fracture of the os humeri, in the vicinity of its articulating head with the scapula, and from the enormous size of the bloody tumour, and the great pressure exercised by

[d] Chapter ix, § 22.

it on the surrounding parts, and the long delaying of the surgeon having occasioned an approaching, or almost inevitable gangrene of the fore-arm and hand. In the midst of so many and so imminent dangers, there does not remain in this case of axillary aneurism, as in that of a prodigious popliteal aneurism of long standing, any better practice to be adopted than that of the disarticulation of the humerus from the scapula, and successively the ligature of the axillary artery above the place where that artery has been wounded.

§ 22. The simple and expeditious manner in which we at present perform the operation for aneurism in the bend of the arm, whether it is by Anel's method, or by means of the incision of the aneurismal sac, forms an interesting contrast with the manner of performing this operation, as was in use in the times of Ætius,[e] and Paulus of Ægina;[f] which ancient mode I think proper to relate here for the convenience of students, in order that from this and the great progress of anatomy, they may know the high degree of perfection which surgery has reached in the present times. Ætius, far from applying the tourniquet, or compressing the humeral artery, in order to moderate and suppress the course of the blood for a given time, as we do, marked the course of the humeral artery from the axilla to the elbow; then following this direction at three or four fingers below the axilla, where the artery seemed to him to beat most strongly, he divided the integuments; he then uncovered the humeral artery, laid it gradually bare, and separated it with singular attention from the cellular substance; he then raised it by means of a blunt hook, and tied it

[e] See appendix, note, No. 17.

[f] See appendix, note, No. 18.

in two places at a short distance from each other; he next divided the artery between the two ligatures, and filled the wound with powdered frankincense and lint. Having done this, he proceeded properly to the operation for the aneurism in the bend of the arm. He then opened the aneurismal sac, sought for the wounded artery in the bottom of it, tied it above and below the wound; then, as before, divided it between the two ligatures, and applied the above-mentioned dressing, intrusting all the rest of the cure to suppuration, as we do, and to the curative powers of nature. Paulus of Ægina also, if it was a case of aneurism, which we call *diffuse*, made an incision into it lengthways, he likewise separated the artery carefully from the cellular substance, tied it with two ligatures at a short distance from each other, and punctured it in the middle space between them, to discharge the blood which it contained; in which circumstance he differed from Ætius, who, instead of puncturing, divided the artery across between the two ligatures. If, however, the aneurism was of that kind which we call *circumscribed*, Paulus laid hold of the bloody tumour with his fingers, perforated it at the base with a needle armed with two threads, one of the threads he tied upon the upper half of the tumour, and the other upon the lower, exactly as was done by him for destroying the *staphyloma*, and which is now practised for removing large hæmorrhoids. Not sufficiently content with this, Paulus cut away, along with the skin, that portion also of aneurismal sac remaining on this side of the ligatures. He did not mention, however, how he stopped the course of the blood before proceeding to the one or the other of these operations; and I cannot well comprehend, how he, who knew, that both the *diffuse* and *circumscribed* aneurisms were formed by extravasated blood, and consequently by a wound of the artery, could flatter himself with curing the *circumscribed* aneurism, simply by the ligature of the sac, when he might have effected it more quickly, and with greater security, by laying bare the artery, as in the first case, and by tying it above and below the wound. In which respect, it appears to me, that Paulus does not merit the eulogium which Dr. Freind has bestowed on him in his History of Medicine.

§ 23. The cure of the external aneurism, which is formed by a rupture of any of the superficial arteries of the third order, such as the temporal, occipital, *external* mammary, that of the palmar arch, of the tarsus, and the like, is easily performed, because these arteries are of a small diameter, and because they are close upon bones, against which they may be conveniently compressed, with security of success, or tied in the ordinary manner.[s] The cure of these aneurisms is accomplished by opening them from the upper to the lower part, with one stroke of a bistoury, and tying the lacerated artery in the usual way, or by means of the tenaculum and waxed thread; or if the mouth of the artery, or of several small arteries, is so lacerated and bruised, that it cannot be conveniently drawn out with the hook, and tied at the bottom, or in the sides of the aneurismal sac, it is to be compressed against the bones, applying over the open orifice of the artery, a piece of sponge well dried, and above it, graduated compresses, and a bandage adapted to the place occupied by the disease, such as the *knotted* bandage for the temple; the *cap* of Hippocrates for the forehead, crown, or occiput; the *circular* bandage of the body for the thorax; that of venesection for the hand, for the tarsus, and the like. Farther, as in all cases of hemorrhage suppressed by means of the ligature, and more particularly when a stop is put to the flow of blood by means of compression, so in the cases of aneurism of which we are now speaking, the dressing ought not to be removed from its situation, until suppuration has commenced, taking great care that the bandage exercise a sufficient and steady pressure. Tulpius, in the case quoted above,[h] of aneurism occurring between the thumb and fore-finger from a puncture, applied upon the tumour an astringent plaster, and over it a plate of lead, which were compressed by means of a proper bandage, and in this manner, according to Heister's account, the patient was cured in the course of four months. This cure, however, might have been very much shortened, by the incision of the tumour, and by compressing the denuded artery, or tying it in the usual way.

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[s] Theden, in speaking of the laying open of gun-shot wounds, mentions the case of a man who was shot through the right hip. As the wound did not heal, an incision was made through the great and middle glutæi muscles, by which the glutæal artery was wounded. The wound was immediately filled with compresses secured by a long roller, the hemorrhage, however, could not be stopped, and the patient died. See appendix, for an account of Mr. J. Bell's case of glutæal aneurism.—*T.*

§ 24. Harderus, in his *Apiario observationum*, *Observ.* 86, speaks of an aneurism of the carotid artery, which appeared in consequence of a wound of the neck by the point of a sword. A surgeon, he adds, undertook to cure this aneurism by the operation; but as, after opening the tumour, he was unable to make a sufficient compression, the patient died among his hands from hemorrhagy. Acrell[i] gives the account of an aneurism, which he called *true*, of the left internal carotid artery, caused by a wound of a musket shot, in which the ball entered on the anterior side of the neck, between the trachea and the trunk of the left carotid. This aneurism, by means of a graduated compression, applied in such a manner as was compatible with the injured part, gradually diminished, so that the artery at the end of six months, had, according to the opinion of the author, re-acquired its strength and natural diameter. What seems more probably to have been the fact in this case is, that a coagulum had formed, and that it having stopped the effusion of blood, had allowed the lymphatic system to absorb that portion of blood which had been before extravasated, and which formed the bulk of the tumour. A case nearly similar to this, may be read in the notes added by Van-Horne to the work of Botallus *de vulneribus sclopet.* cap. xv, pag. 6. Anatomy, and experiments performed on brutes, furnish us with a certain and constant fact with regard to this subject; that is, that the ligature of one of the carotids, may be made without the animal giving evident signs of the functions of the head being disordered.[k] I have made a great many of these experiments, and always with the same success. Another fact, equally certain, is, that on the carotid artery being obliterated below the aneurism, the tumour gradually diminishes in bulk, and disappears, in the same manner as the aneurism in the bend of the arm, or thigh, operated on by the Anelian or Hunterian method. This fact is proved by the observation of M. Petit,[l] quoted above, made upon the dead body of the advocate Vieillard, who, during his lifetime, had been cured by the powers of nature of an aneurism in the bifurcation of the right carotid artery, by means of the spontaneous obliteration of that portion of carotid, which extended from the right subclavian artery to the origin of the aneurism. The truth of these facts, therefore, being established, and supposing the case that the aneurism of the carotid was situated so high in the neck, as to leave below it a sufficient space for allowing the aneurismatic carotid artery to be brought into view, and tied separately from the par vagum, it appears to me, that the proposal of applying the ligature of the carotid below the seat of the aneurism ought not to be rejected, and that in similar cases the operation ought to be attempted.[m] Certainly, by operating in this way, there would be no necessity for having recourse to any means for moderating the flow of the blood during the time required for the application of the ligature, and we would run no risk of an alarming and fatal hemorrhage, as there is every reason to believe would happen, by making the incision of the tumour, in order to evacuate the clots of blood, and tie the carotid in two places in the bottom of the aneurismal sac. I am perfectly aware, considering the shortness of the human neck, of its being a different thing the laying bare the carotid in brute animals and in man; but if it has been acknowledged to be possible to perform œsophagotomy in man, I am convinced that the laying bare and tying the carotid separate from the par vagum, would be equally so, provided, I repeat it again, the rupture of the carotid had taken place high up, and in the vicinity of the angle of the lower jaw, and provided that the bloody tumour be not of a very large size, and consequently leave sufficient room below it towards the sternum, for being able to reach the carotid; an operation not at all bloody, if it is performed in such a manner as not to touch the aneurismal sac.

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[h] Chap. vii, § 17.

[i] Chirurgische forfälle, 1. Band. pag. 255.

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[k] Hebenstreit, in the 5th volume of his translation of Mr. B. Bell's system of surgery, mentions a case which he had met with, where the external carotid artery was wounded in the extirpation of a scirrhous tumour. The profuse hemorrhage, which instantly ensued, would soon have destroyed the patient, if the surgeon had not immediately recollected himself, and tied the trunk of the artery. The operation was successful, and the patient lived many years after it. See in the appendix, an account of a case where the carotid artery was tied by Mr. Abernethy.—*T.*

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[l] Chap. viii, § 3.

[m] Mr. Astley Cooper performed the operation of tying the carotid artery on account of a carotid aneurism in a woman aged 44 years. The ligature came away the twelfth day after the operation; on the seventeenth day from the operation, inflammation began in the aneurismal sac, which proceeded to suppuration, and produced such pressure on the trachea and œsophagus, as to make respiration difficult, and deglutition impossible, and on the twenty-first day from the operation, she died. The case will be published with plates, in the first volume of the memoirs of the Medical and Chirurgical Society of London. *T.*

CHAPTER XII.

OF THE ANEURISMAL VARIX.

§ 1. SURGEONS understand by the name of *aneurismal varix*, that particular kind of aneurism, in which the blood effused from the wounded artery, is not contained in a sac formed by the cellular substance surrounding the injured artery, but by the cavity of the coats of the neighbouring vein, lying immediately over the injured artery. This particular kind of aneurism may occur in any part of the body, where the veins lie close upon the arteries; and Lassus mentions, that he had seen, in company with several other professional persons, an aneurismal varix in the cavity of the ham, occasioned by a wound of a sword, which had transfixed the popliteal vein and the artery at the same time.[a] However, this accident more commonly occurs in the bend of the arm, in consequence of a bleeding incautiously performed. For, whenever the point of the lancet, having pierced the vein through and through, enters the subjacent artery, the arterial blood, favoured by the approximation of the two vessels, instead of being effused into the cellular substance, passes directly into the vein lying over it, and raises it in the manner of a varix, and returns by it to the heart.

§ 2. In order, therefore, that after a venesection, an aneurismal varix take place rather than an aneurism, it is necessary that there be the concurrence of two circumstances; 1, That, on withdrawing the wounding instrument, the incision made through the vein, and the opening made in the artery be exactly in the same direction; 2, That the solution of continuity in the integuments of the anterior side of the vein unite, and consolidate by the first intention, as in the common cases of venesection, while the wound of the posterior side of the vein, and that of the anterior surface of the artery remain open, and so exactly communicating with each other, that the arterial blood finds greater facility in entering from the artery into the vein, than in being effused from the artery into the surrounding cellular substance.

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[a] Med. operat. t. ii, p. 442.

§ 3. If one of these two circumstances be wanting, either because the wounding instrument has entered the artery a little obliquely from the vein, or because the vein has not approached sufficiently to the artery, on account of the cellular substance lying between them, the arterial blood, most frequently, does not produce the *aneurismal varix*, or, if it does indeed produce it, the disease is always complicated with effusion of arterial blood into the cellular substance, or with an aneurism, and aneurismal varix at the same time; in which case, the small aneurismal sac serves as a short canal[b] of communication between the artery and the vein; so that in this case it may with propriety be said, that there are formed from the same cause two distinct diseases, placed the one over the other, that is, an aneurism, and an aneurismal varix.[c]

§ 4. The aneurismal varix forms always a *circumscribed* tumour; aneurism does not always do so.

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[b] Med. facts and observ. vol. iv, p. 115, *c*, *b*.

[c] Ibidem, *c*, *a a*.

The cellular substance which constitutes the sac of the aneurism, does not always resist so strongly the impetus of the arterial blood as the coats of the vein do. Aneurism, therefore, not unfrequently, from being *circumscribed* at first, becomes *diffuse*, extends along the course of the wounded artery, compresses strongly the parts surrounding it by the coagulated clots of blood, occasions acute pain and inflammation, and threatens the gangrene of the part where it is situated. The aneurismal varix, on the contrary, is always *circumscribed*, increases very slowly, does not occasion considerable pain to the patient, and as it augments, it extends invariably, sometimes more, sometimes less, above and below the place where the bleeding has been performed; and this extension is in proportion to the greater or less force with which the arterial blood is thrown from the artery into the vein, and the greater or less resistance opposed by the valves situated in the vein below the place of the venesection; and lastly, according to the greater or less number of veins communicating with the aneurismal varix.

§ 5. The aneurism and the aneurismal varix, both pulsate after the manner of arteries. The aneurismal varix pulsates in that manner, because the vein receives the stream of arterial blood at intervals, and *per saltum*. And since, on account of the wound of the lancet made in the artery being in general very small, the arterial blood passes through a narrow hole of communication between the artery and vein, so the arterial blood in the act of entering the cavity of the vein, and spreading in it, excites a sort of hissing or whizzing noise, accompanied by a singular tremulous motion of the coats of the vein, which tremulous motion gradually abates, and ceases altogether at a certain distance above and below where the venesection has been performed. This noise of the vein is rendered still more sensible, if one extremity of a probe be rested upon the aneurismal varix, and the other end of it be held between the teeth. The vein, in all this, similar to the sac of the aneurism, is only passive. For, if blood is made to pass from the carotid artery of a calf into the jugular vein of a sheep, by the intervention of the dried gut of a fowl, which I have done repeatedly, both the gut and the vein pulsate, exactly as the arteries do, and in both, a tremulous motion is felt, a noise very much resembling that which is met with in the aneurismal varix.

§ 6. As a considerable portion of arterial blood, which ought to descend to the arm and hand by the radial and ulnar arteries, turns into the vein in the bend of the arm; so it necessarily happens, that in the arm affected by aneurismal varix, the pulse at the wrist becomes less strong and vibrating than that of the sound arm; and that also in progress of time, the pulse is rendered still less sensible to the touch, on account of the arteries of the fore-arm (being defrauded, to use the expression, of the usual quantity of blood), having a continual tendency to contract.

§ 7. The marks, therefore, by which the aneurismal varix in the bend of the arm may be distinguished from aneurism, are numerous and evident. The seat of the aneurismal varix is generally in the basilic vein, which appears dilated in an unusual manner, forming an oblong tumour of the size of a walnut, if the disease is recent, and of a small elongated nut, if the disease is of somewhat long standing. The small tumour has in its centre the cicatrix of the bleeding, The vein is less dilated, the more it is removed from the cicatrix of the bleeding, and for the most part the vein at the distance of two inches and an half above and below the tumour, resumes or retains its natural size. The small tumour, as has been mentioned, pulsates after the manner of the arteries, with a tremulous motion, and hissing noise, which is sometimes so great, that the patient cannot sleep, if he is lying with his head low, and resting on the injured arm. The trunk of the brachial artery, from the axilla, as far as the place where it has been wounded by the lancet, vibrates with extraordinary force. The aneurismal varix does not cause any change of colour, or inflammation of the skin, and the pain excited is inconsiderable. It is flexible, and when compressed by the fingers it diminishes, yields, and empties itself of the blood which it contains; but, on removing the pressure, it rises again, and is filled with arterial blood as before; which phenomenon happens in like manner, when the arm has been tied firmly below the aneurismal varix, and consequently below the bend of the arm. On the contrary, the aneurismal varix becomes flaccid, falls down, and almost disappears, if the patient keeps his arm raised for some time towards his head. The same thing happens when the small tumour is compressed in such a manner, that the point of the finger pressed down deeply, rests upon the opening in the artery, or if a tourniquet is applied and tightened upon the humeral artery in the vicinity of the axilla.

§ 8. Farther, when the aneurismal varix is complicated with incipient aneurism, formed by blood extravasated into the cellular substance situated between the artery and vein, through which small aneurism[d] the one vessel communicates with the other by means of an intermediate canal. Besides the marks above mentioned, a second tumour is met with at the place where the bleeding has been performed, and immediately behind the posterior side of the aneurismal varix; and this tumour pulsates in like manner, and disappears when compressed; and it is felt clearly by the touch that it is as it were united to the subjacent artery, and that the aneurismal varix forms no part of it, but merely lies over it. This second tumour remains stationary as long as the arterial blood continues to pass with a certain degree of facility from the artery into the vein. On a change taking place in the above-mentioned circumstances, the tumour lying below the aneurismal varix increases very much, and is converted into a large aneurism, sometimes even diffused.

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[d] Loc. cit. *a, c, b.*

§ 9. From a passage in Sennertus,[e] it seems we may infer, that that great practitioner had had an opportunity of observing this disease; but not having recognized its nature, he had classed it among the ordinary aneurisms in the bend of the arm in consequence of venesection. Dr. William Hunter[f] is, without doubt, the first to whom we are indebted for the accurate ideas we are at present in possession of with regard to the nature of this disease, Upon which point, however, I cannot omit mentioning, that Guattani,[g] at the same time as Dr. Hunter, or certainly before Dr. Hunter's investigations with regard to this particular kind of aneurism were known in Italy, had published the history of two cases of aneurismal varix, with regard to the true nature of which disease described by Guattani there cannot be the smallest doubt. It may therefore be said, that he had an equal share in the merit of the discovery.

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[e] Oper. Omn. t. v, lib. v, part i, cap. 43. Novi vicinam meam quamdam, cui imperitus chirurgus, dum venam secare deberet, arteriam aperuit, quæ jam ultra trigesimum annum aneurisma nucis juglandis magnitudine in cubiti flexura interna habet et alias satis commode hactenus valet. Sibilus non saltem digitis sentitur, sed etiam admota aure; quod fit ob spiritus vitalis per angusta meantis motum.

[f] Medical Observations and Inquiries, vol. i, ii.

§ 10. The prognosis of this disease differs, according as the aneurismal varix is simple, or complicated with a small aneurism situated between the artery and the wounded vein. In the simple aneurismal varix, whether it is recent or of long standing, provided the orifice of the posterior side of the vein remains connected in such a manner with that of the anterior side of the artery, so that the arterial blood passes freely from the latter into the former, without being at all effused round the artery into the neighbouring cellular substance, the consequences of the disease, as far at least as appears from the observations hitherto made, are not for the most part to be feared, provided the patient is very careful not to make violent and frequent motions with the affected arm. For, as soon as the basilic vein, and together with it some other veins of the bend of the arm communicating with the basilic vein in the vicinity of the seat of the pulsating varix, has acquired a certain degree of dilatation above and below the bend of the elbow, the aneurismal varix invariably becomes stationary during all the rest of the life of the patient who is affected with it, to whom it does not occasion any other inconvenience than netimes a sense of transient numbness, or some mentary debility of the whole arm and hand. The gnosis is not equally favourable in the case of aneumal varix complicated with incipient aneurism situd between the artery and the wounded vein. The erial blood in its passage through the cellular caple of the small aneurism into the vein, does not serve constantly and entirely its fluidity, as in the ceding case, but stagnates always a little during s passage in the small sac, and gradually leaves re some fibrous layers. If in similar circumstances patient does not abstain entirely from exercising arm with force, and from making violent motions, coagulated blood, and the layers and clots of it uated below the varix, gradually enlarge the aneumal sac, and in progress of time increase it to such eight, that, compressing the contiguous parts, it cites pain and inflammation in them, threatens to come diffuse, and even to burst externally; in a rd, the patient is under the necessity, in order to e his arm and his life, of submitting to the operan which is practised for aneurism in the bend of the n.

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[g] See Appendix, note, No. 19.

§ 11. The cure of the simple aneurismal varix, it is, when there is a free and immediate passage for blood of the humeral artery into the basilic vein, hough the disease has been of some months stand, and the basilic vein be considerably enlarged, will nsist chiefly in ordering the patient, in the most pree manner, to abstain from fatiguing the arm with lent exercise, and to keep it as little as possible nging by his side. Dr. Cleghorn[b] suggested, very prudently, to a journeyman shoemaker, who had met with a similar misfortune, to change his trade, and to learn that of weaving hair for making wigs. Any kind of compression or bandage whatever, which is not sufficient to obliterate the vein and approximate it firmly to the artery opposite to the place of the wound, or which is not sufficient to render the artery impervious at the seat of the puncture made by the lancet, never can be a radical means of cure. A bandage employed with the view of preventing the basilic vein receiving the blood, which is sent into it from the humeral artery by the unnatural anastomosis, might cause the arterial blood to infiltrate into the cellular substance lying between this artery and the vein, and produce a disease worse than the first, viz. an aneurism, and would make it increase rapidly if the aneurism was once begun. Experience, on the contrary, has shewn us, as has been already mentioned, that the natural resistance of the coats of the basilic vein, and of the other veins communicating with it in the vicinity of the aneurismal varix, beyond a certain degree of distension, is equiponderant, to use the expression, with the impetus of the blood thrown in by the artery, and that in this state of circumstances the aneurismal varix remains stationary for a long series of years, and during all the life of the patient who has met with this misfortune. A middle-aged lady, of a very good constitution, was affected, in consequence of a bleeding, with an aneurismal varix, of the size of a large elongated walnut, in the bend of the right arm, exactly in the basilic vein. Two years after this accident, as she saw that the tumour had increased a little, she was deeply afflicted by the dread of its coming to burst. She consulted me on that account; and as the state of anxiety in which the patient lived proved to her a disease worse than the aneurismal varix, I therefore directed her to wear day and night, all along the right arm, as far as the shoulder, immediately above the skin, a sleeve of silk wove with an elastic stitch, exactly similar to the elastic stockings of English manufacture; farther, that she should endeavour to keep her arm always a little elevated. The application of the elastic sleeve was sufficient to calm the mind of the patient. Fourteen years have now elapsed since the accident; and she even lately has assured me by letter, that the tumour had not at all increased since the first time that I had seen her; that she does not suffer any inconvenience in the arm, except some transient numbness, especially in great and sudden changes of the atmosphere. In the lady who was the subject of the first of Dr. Hunter's observations, after thirty-five years the aneurismal varix was nearly in the same state in which it was soon after the accident. Dr. Cleghorn's patient after twenty years had not experienced any other change than a little more swelling of the veins in the bend of the arm communicating with the aneurismal varix, and that notwithstanding he made use of his arm as before, and had resumed his trade of shoemaker.[i] Mr. Pott asserts, that he had seen the aneurismal varix in three different persons, in none of which the operation was necessary. The same thing was remarked by Mr. B. Bell,[k] by Garneri,[l] and by several other surgeons worthy of credit.

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[b] Medical Observations and Inquiries, loc. cit.

§ 12. There are some examples of a radical cure of the aneurismal varix obtained by means of compression. Indeed, if the regular compression, continued for a long time, has been sometimes sufficient for curing radically the aneurism in the bend of the arm and in the ham, we may conclude from analogy, that the same means, in a similarity of favourable circumstances, may produce the radical and complete cure also of the aneurismal varix. Whenever the compression of these parts against the bone is such that it falls exactly upon the wounded place of the vein and artery, and that the sides of both of these vessels be brought and kept in perfect and firm contact for a proper length of time, on the supervention of the *adhesive* inflammation excited by the pressure, there can be nothing to hinder the coats of these vessels contracting a firm adhesion to each other, and producing a cure, whether it is effected by the obliteration of the vein only at that place, and the firm approximation of it to the wounded artery, so as to oppose a firm and secure barrier to the discharge of the arterial blood, or whether it is accomplished by means of the obliteration of the vein, together with the humeral artery, for some space above and below the wound made by the lancet. The two Brambillas[m] have communicated two examples of similar cures. The first was in a woman thirty years of age, in the sixth month of pregnancy, in whom, after having been bled in the left arm, there appeared an aneurismal varix, accompanied with extensive ecchymosis and painful swelling, although not inflammatory, along the biceps muscle. The cure was undertaken four days after the accident by means of compression, by placing upon the tumour a ball of lint dipped in styptic water; over this, graduated compresses, and a roller with many circles round the bend of the arm. In the course of six months, the most scrupulous attention being paid to the renewal of the bandage when it began to relax, the patient was radically cured. The other case was of a boy fourteen years of age, in whom the compression was employed a fortnight after the appearance of the aneurismal varix. In the course of fourteen weeks of assiduous treatment, this boy was cured, and there only remained at the place of the aneurismal varix a very small hardness about the size of a pea. Guattani,[n] in a similar case of aneurismal varix, after having shewn and instructed a country surgeon in the manner of applying the compression and the bandage upon the pulsating tumour of the basilic vein, sent the patient home, and from the account given him by the surgeon of the place, he was afterwards informed that the patient was cured. Monteggia[o] likewise obtained the cure of an aneurismal varix which was of a month's standing, and this he effected by means of proper rest and compression. He observed in this case, that a coagulum was formed in the varix, which then became hard, lost its pulsation, and soon after disappeared.

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[i] Bell. A System of Surgery, vol. iii, p. 203, note.

[k] Loc. cit.

[l] Bertrandi Oper. Post. Delle operaz. chirurg. t. iii, p. 208.

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[m] Acta Acad. Cæs. Reg. Joseph. t. i.

§ 13. As from what has been said it appears that compression does not produce the complete cure of this disease, except in so far as it occasions the union of the opposite sides of the vein or artery, or of both together, above and below the injured place, and that it is a certain fact, that whenever the compression is not sufficient to do this, far from being a means of cure, it rather puts the patient in great danger of the aneurismal varix becoming complicated with aneurism, so it will be prudent in the surgeon not to try the compression, except in cases of recent, very small aneurismal varix, in young or very slender persons, in whom it is clearly seen that the vein is in contact with the artery, and that both of these vessels can be firmly and steadily compressed against the lower extremity of the bone of the humerus in the vicinity of the internal condyle. In young and thin persons the point of the wound made in the artery may be determined in most cases with the greatest precision. For, by pressing firmly the point of the finger upon the centre of the varix, we may distinctly feel the orifice of the artery from which the blood passes out of the artery into the vein, and in some cases so plainly, that it would be possible to pass a pin through the skin and vein, and introduce it directly by that orifice into the tube of the artery. In cases, therefore, quite opposite to this, that is, when the aneurismal varix is of very long standing in persons with fleshy arms, in whom, in compressing the centre of the tumour, the orifice of the artery, from which the blood passes into the vein, cannot be distinctly felt; when both of these vessels cannot be compressed so completely against the os humeri as to bring their opposite sides into firm and steady contact with each other; when, lastly, from some particular circumstances, the surgeon cannot give assiduous and careful attendance on the patient, the best measure that can be adopted will always be, not to risk the compression of the aneurismal varix, but to rest satisfied with giving the patient those directions which I have mentioned above.

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[n] De Spur. Brach. Aneurysm. histor. iv.

[o] Instituzioni Chirurgiche, t. i, pag. 187.

§ 14. Poor people, obliged to lead a laborious life, do not always pay sufficient attention to these directions. They return to their trades, and to the violent exercise of the affected arm, and sooner or later, if the aneurismal varix be from the first complicated with incipient aneurism, a considerable portion of the arterial blood oozes out, and stagnates in the cellular substance between the artery and vein; the aneurism then becomes prominent as well as the vein; and the former ceasing to be *circumscribed*, threatens to become *diffused*. In this very urgent state, the surgeon will not hesitate to perform the Anellian operation, if the aneurism is still small and *circumscribed*. For it is evident, without my mentioning it, that on suppressing the current of blood through the trunk of the humeral artery, the aneurismal varix must disappear, and no more blood passing from the artery into the vein, both the wound of the artery, as well as that of the posterior side of the vein, must of necessity close and cicatrise. But if the aneurism is *diffused*, the surgeon will give the preference to the incision of the aneurismal sac, with those cautions which the complication of the two diseases, lying the one over the other requires; and these I shall now point out.

§ 15. In this second complicated case, or of aneurismal varix and *diffuse* aneurism, having applied the tourniquet upon the trunk of the humeral artery in the vicinity of the axilla, the surgeon will open the aneurismal varix in its whole length, and will dry the cavity thoroughly with a soft sponge; after this, he will discover at the bottom of this cavity, the orifice made by the lancet in the posterior side of the dilated vein. Having introduced a probe by this orifice, he will perceive that he has penetrated into a second sac below the first, but not into the artery, from the facility with which he moves the probe all round, and the difficulty of pushing it in the direction of the arm lengthways; or according to the course of the humeral artery. Therefore, upon the probe as a guide, he will dilate this orifice with the point of the bistoury, or with a pair of scissars, and at the same time, open through its whole extent the second lower sac also, which is formed by the cellular substance, or the proper aneurismal sac, which he will find full of clots and coagulated layers of blood. Having evacuated the clotted blood, and cleaned this second sac also with a sponge, the wound of the artery will present itself at the bottom of it, and having introduced a probe through this orifice, he will find that he can make it pass easily upwards and downwards along the course of the humeral artery. By means of the introduced probe he will raise the humeral artery, will separate it with the point of the fore-finger of his left hand, from the cellular substance which keeps it united to the contiguous parts, then from the median nerve and vein, if he think it proper, in order to lay bare the artery as completely as possible; he will then tie it above and below the wound, following the rules laid down in the preceding chapters. The following case will illustrate more fully the method of operating just described.

§ 16. John Hartley,[p] a youth about twenty years of age, presented himself at the Liverpool infirmary in May 1791. His account of himself was, that he had been bled in the right arm in the preceding January; that he had more than usual pain at the time, and thought he had been pricked too deep; that he continued his work, (that of a wheel-wright), for a week after the operation, and then perceived a small hard tumour immediately under the orifice, which had gradually increased to the size of a walnut. Mr. Park, the surgeon, observed that the tumour pulsated like an aneurism, and on pressure, disappeared in a considerable degree, but not entirely; from which it was evident, that the whole of the arterial blood contained in it, was not in a state of fluidity, but that some coagulum was formed. The hissing and peculiar thrilling sensation which characterise the aneurismal varix, were very plainly perceptible for a certain distance from the centre of the tumour towards the axilla. The basilic vein was a good deal distended, but not in the degree which Doctors Hunter and Cleghorn describe in their cases of varicose aneurism, the tumour being still on the increase, though slowly.. Although the blood of the wounded humeral artery passed into the basilic vein, yet there was reason to suspect, from observing, that on pressure being applied, a portion of coagulated blood remained behind, that this communication did not take place with such facility as to secure the patient from being afterwards exposed to the necessity of undergoing the operation of the ligature of the humeral artery. He was therefore advised to refrain from making violent exertions with his right arm, and to return to the hospital as soon as he perceived any remarkable change in his right arm. He returned again to the infirmary a few months afterwards, when it was remarked, that the tumour had manifestly increased, and with great rapidity; that is, not in that slow gradual manner which is usually observed in the increase of the aneurismal varix.

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[p] Medical Facts and Observations, vol. iv.

On the 21st of January of the following year, he came into the infirmary on account of a violent pain which he felt in the tumour, accompanied by inflammation and suppuration, and the tumour threatened to burst. This he attributed to accidental cold to which he had been exposed; but it seemed more probable, that it was to be ascribed to the sudden increase of the tumour. An emollient poultice was applied, and a tourniquet was put loosely round the arm, with directions that he should be closely watched day and night. The next morning the tumour burst; a small quantity of pus was discharged, the tumour subsided a little, and the patient became considerably easier.

On the 24th in the evening, the arterial blood burst forth with considerable force, the tourniquet was tightened by the nurse, and the surgeons were called as soon as possible. Having opened immediately the external sac, or the aneurismal varix, and evacuated the coagulated blood, an orifice was discovered at the bottom of the cavity, similar to that which is usually made in venesection, from which arterial blood flowed, on loosening the tourniquet. A probe introduced into this orifice,[q] sunk nearly an inch deep;[r] but would not pass much more than half an inch upwards or downwards along the arm. On this account, Mr. Park, not being perfectly certain if the probe had entered the tube of the artery, or into a second sac, did not venture to apply a ligature to the artery. He therefore enlarged this orifice with the scissars, and he found that it led into a second sac below the first. Having evacuated the blood which filled it, he discovered at the bottom of this second and lower sac, the wound of the artery;[s] and a probe introduced into this, passed readily upwards and downwards in the direction of the artery.[t] Directed by this probe, a ligature was passed underneath the artery, above the orifice, and tied. On loosening the tourniquet, as the blood flowed out as freely as before, the humeral artery was also tied below the wound; and then no farther hemorrhage appeared.

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[q] Loc. cit. pag. 115, *b.*

[r] Ibidem, *e.*

[s] Ibidem, *d.*

[t] Ibidem, *c*, *e.*

The wound was kept open more than half an hour, (waiting to see if any more hemorrhage would take place), and then the dressings were applied, and the edges of the incision were brought together by means of slips of adhesive plaster.

The next day, the œdematous swelling that had taken place in consequence of the long continued application of the tourniquet, was considerably diminished. There was a sufficient degree of warmth and feeling in the fore-arm, and a faint pulsation was felt in the radial artery. After this, nothing remarkable occurred during the cure, excepting that the patient was so much threatened with symptoms of phthisis pulmonalis, as to make it necessary to send him into the country before the wound was completely cicatrised. By the 29th September, the patient was completely cured, had an evident pulsation in the artery at the wrist, though not quite so strong as in the other. Nevertheless, the operated arm was equally strong and well nourished as the other arm.

As Dr. Hunter, (adds Mr. Park), judiciously and humanely published the result of his cases, with a view to prevent patients with aneurismal varix being improperly and unnecessarily exposed to the operation of the ligature of the humeral artery, so I think it incumbent on me to state this case, as a caution to inexperienced practitioners, whenever they meet with such appearances as the doctor has described, but in a less degree, to be well assured that the veins will really dilate sufficiently to take off the whole of the blood poured out by the artery, before they give such a prognostic as may lull the patient into a delusive and dangerous security, and neglect taking those precautions which are necessary for preventing the disease growing worse, which is as much as to say, for preventing the aneurismal varix being complicated with aneurism.

A case very similar to that related by Mr. Park, occurred to Dr. Physick of Philadelphia. (See Medical Museum, vol. i, p. 65.) The patient had been bled in the basilic vein upwards of two years before. No difficulty was experienced at the time in stopping the blood, but a considerable ecchymosis formed, occasioning a livid colour about the wound, extending above and below the elbow. The ecchymosis disappeared in a few days; but a pulsating tumour was observed directly under that part of the vein which had been punctured; this tumour increased in size for six months, afterwards, its increase was so slow as not to be observed, though the basilic vein running over it began to enlarge.

On examining the arm, Dr. Physick remarks, a tumour was found at the bend of the arm pulsating very strongly, exactly resembling a *true* aneurism; there were also two tumours, one situated above, and the other immediately below the aneurismal sac, in which the particular thrill always met with in aneurismal varix, was very distinctly felt. These tumours were evidently distensions of the basilic vein, the trunk of which, however, for about three fourths of an inch, where it passed over the aneurismal sac, was very little enlarged; by making pressure on the middle of this last-mentioned portion of the vein, the orifice of communication between the aneurismal sac and the vein could be felt; and by applying the finger very accurately over it, the flow of blood into the vein could be prevented, and the thrill, while the pressure was continued, ceased.

There could be no doubt with regard to the nature of this case; the artery had been wounded by the lancet pushed into it through and through the vein; the pulsating tumour was a sac formed in the cellular membrane between the artery and vein, by the impulse of the arterial blood: this sac continued to enlarge till its sides became firm and resisting, then the blood was thrown with such force into the vein through the puncture in its lower side, as to cause it to be distended very considerably for two or three inches below the sac; the intermediate portion of vein running over the sac being supported by it, was very little enlarged.

As the distension of the upper portion of the vein went on very rapidly, and the skin covering it became thin, so as to make the patient apprehend a rupture of it; and as the fore-arm was much diminished in size, and the hand always cold, and as the existence of the aneurismal sac was evident, Dr. Physick was induced to recommend the operation of tying the artery above and below the sac. In about a quarter of an hour after the operation, the pulse of the artery at the wrist was distinctly perceived; in three weeks the wound was cicatrised, and the patient recovered the perfect use of his arm. *T.*

CASES.

CASE I.

POPLITEAL ANEURISM.

Joseph Fiorini, nurse of this hospital in Pavia, a ſtout corpulent man about 42 years of age, addicted to drinking of spirits, who had been infected several times with lues venerea, and cured repeatedly by the use of mercurial medicines, in the beginning of the year 1799, observed that he had a slight œdema of the right leg and foot during the day, which disappeared after a night's rest. He had always had from his early years a difficulty in walking, as of a person who has tender feet. Some months after, wishing to get entirely rid of this inconvenience, he applied the *expulsive* bandage; but as he perceived that the swelling during the use of the bandage, quitting his foot and leg, appeared upon his knee and thigh, he left it off. In September of the same year, he observed for the first time, that a tumour had appeared as big as a large nut, in the upper part of the cavity of the right ham, accompanied with slight pain. He applied emollient poultices to it, during the use of which, the tumour increased considerably, so that in February of the year 1800, he was obliged to keep his bed. On the 24th of the same month, I saw this patient for the first time. I found that he had a tumour in the cavity of the right ham as large as the fist, which pulsated strongly, and presented all the characters of an aneurism. I made an attempt to ascertain if the patient could bear compression; but after twenty-four hours, I was sensible of the insufficiency of this method, or rather of the injury which it would have occasioned, had I wished to persist in the use of the compressive bandage. On which account, I immediately determined upon the Anellian or Hunterian operation, which I performed exactly in the manner described above.[a] After I had tied the *superficial* femoral artery in the upper part of the thigh, the aneurism immediately ceased to beat; and from being tense and hard before the operation, it became, at the same moment that the artery was tied, soft and compressible. On comparing the circumference of the aneurism with the measure which had been taken of it before the operation, it was found, that the tumour had diminished some lines, by the cutting off of the column of blood which flowed into it by the *superficial* femoral artery. An hour after the operation, the patient complained of a painful sensation in the right groin, and corresponding testicle. This symptom was relieved by the application of a spunge squeezed out of warm water to the pained part. The patient passed the night quietly enough, except that he had some starting of the operated limb. Next morning he complained of a sensation, as if water was running down through his thigh to the right leg and foot. The heat of the operated limb exceeded that of the sound limb by some degrees.

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[a] Chapter ix, § 20.

On the second day, the patient was affected with a slight degree of fever. And as he had a bitter taste in his mouth, and as his tongue was covered with mucus, I ordered him a grain of tartar emetic, with three drams of cream of tartar, to be taken in a pound and an half of the decoction of the root of the dog-grass, in small doses. Towards evening he had two copious stools, and soon after taking the medicine, some vomiting. He rested quietly the whole of the night.

On the third day the fever was more brisk, and the pain re-appeared in the right groin and testicle, but was relieved as before by emollients, or the application for some hours of a poultice of bread and milk. This symptom recurred twice during the cure, before the sixteenth day after the operation, and was removed by the same remedies.

On the fourth, the fever was less violent than on the preceding day. There appeared in the wound symptoms of suppuration; I therefore changed the dressings, introducing a pledgit spread with simple ointment between the outer lips of the wound.

On the seventh day the wound was in full suppuration. From this to the eighteenth day, the patient felt no uneasiness, except a slight colic; from which he was successively relieved by the use of emollient and oily glysters.

On the eighteenth day after the operation, the bottom of the wound having already risen considerably, the ligature of the artery came away along with the matter, and at the same time the roll of linen. In the evening of the same day, the patient thinking it certain that he had nothing more to fear from hemorrhage, moved himself freely in bed; which pressed out, to use the expression, a little blood from the lips and bottom of the wound, but it was stopped immediately on his remaining quiet, and by the renewal of the dressings.

On the twenty-sixth day after the operation, the wound had risen so much from the bottom, as to be on a level with the integuments, and it was not more than two inches in length, and half an inch in breadth.

By the 13th of April, the wound was completely cicatrised, and the aneurismal sac had already diminished more than two thirds of the size it had before the operation. The leg and foot of the operated limb were perfectly similar to the leg and foot of the sound limb.

On the 14th of April, the patient began to get out of bed, and to step about a little with the assistance of crutches. On the 27th of the same month, he only required in walking the support of a stick.

About the middle of June of the same year, the patient of whom we are speaking was disposed to resume his occupation as nurse, when he was attacked by transient pains along the leg, and in the calf of the operated limb, without, however, any evident swelling of these parts. By a few days rest, and by means of mercurial frictions to the foot, leg, and ham of the same limb, these affections were removed in less than a fortnight, and Fiorini was at last able to resume his occupation. Eight months after the operation, the aneurismal sac, which before, as has been said, was as large as a fist, was found to be reduced to a small oblong knot, which did not excite any inconvenience. At present, five years have elapsed since the operation; and on examining carefully the ham of this man, I find, that even this small knot has entirely disappeared, and there is not the smallest mark of his having been affected with any disease in the ham.

CASE II.

POPLITEAL ANEURISM OF LONG STANDING, AND OF EXTRAORDINARY SIZE.

ANTONIO VEGRINI, of San Leonardo, a meagre, emaciated, pale man, about 46 years of age, in the beginning of April 1799, was admitted into this hospital on account of a large aneurism, which he had had for nine years in the left ham, and which had lately occasioned him most acute pain, want of sleep, and fever. The tumour was one of the largest of any of this kind which I have ever seen, as it was as large as the head of an adult. The patient could assign no cause for the disease except his trade, which was that of a weaver. The skin covering this immense tumour, was tense, shining; in some places of a red livid colour; in others, intersected with large varicose veins; in others very thin, and ready to burst. The fever by which the patient had been exhausted, had the type of a continual remittent. I made the patient take the bark, with the addition to each dose of a few drops of laudanum, and I ordered him to be fed with rich soups. Towards the end of April, although the fever was considerably abated, the excruciating pains, and the want of sleep, continued as before. I was very much puzzled about the practice which it was proper to follow for the benefit of this patient. The observations of the most celebrated practioners with regard to the unhappy event of the amputation of the thigh in similar cases, presented themselves to me; and I had not at that time conceived the idea of tying the femoral artery in the upper part of the thigh, and afterwards disarticulating the leg at the knee. On the other hand, the enormous size of the tumour, the very acute pains, and the want of sleep, which were occasioned by the excessive distension of the integuments, and the threatening of an approaching rupture of them, placed the patient in immediate danger of losing his life. Further, I was fully aware, that the posterior and inferior surface of the thigh, must be bare and corroded for a small space. However, I wished to try the Hunterian operation, with the hope, that when the principal current of blood towards the cavity of the tumour was suppressed, and the patient recovering some degree of general strength, there would then be time to reflect upon some other method, which if not capable of curing the patient radically, might at least tend to prolong his life. On the 28th of April, therefore, I performed on this patient, the ligature of the *superficial* femoral artery in the upper third of the thigh, which operation was very easy, on account of the emaciation of the patient. In the act of tying the artery, the acute pains of the ham abated as if by enchantment, and the aneurism lost the excessive degree of tension. The patient after the operation slept quietly for three hours. He was afterwards supported with good strong soup every two hours, and he passed the day and following night quietly.

On the third day, the suppurative fever began. On the fifth, there appeared symptoms of incipient suppuration, and the dressings were changed. On the seventh, the fever abated completely, and the wound seemed to look well. I prescribed for the patient a decoction of bark. On the eighteenth day after the operation, the ligature and roll of linen came away spontaneously. On the thirty-sixth, the small incision was completely cicatrised. Nothing could go on better with regard to the ligature of the femoral artery. The aneurismal tumour however did not suffer the changes corresponding to the intention; for, although it diminished a little at first, it afterwards remained stationary, and in an evident state of atony; and what is still worse, the skin covering it had begun to burst in two points, so thin had it become previous to the operation. Such was the state of affairs, when a student in surgery took the liberty, without my knowledge, to carry a surgeon of the Russian army to see the patient. Both of them, not aware of the particular circumstances of the case, handled and squeezed the tumour in such a rough manner, to ascertain whether there was any deep pulsation in it, that the whole aneurismal sac was burst by the pressure, and the clots of blood, with which the tumour was filled, issued out in great quantity, and without interruption, but not a drop of fluid arterial blood.

This happened in the evening. The following morning, I found the patient quite depressed in his mind, and very feeble, and he complained of intense pain in his ham. The clotted blood that had been discharged formed a very considerable mass. On examining the ham, I found, instead of the tumour, a vast cavity, in the bottom of which, a portion of the thigh-bone was distinctly perceived to be bare and corroded. Mortification immediately attacked this large and atonic sac; every thing that art could suggest of any efficacy, was employed for raising and supporting the strength of the patient; but every assistance was unavailing, and he died three days after this accident. The foot and leg were not affected by the gangrene; which was farther confirmed by the dissection of the body publicly performed. It appeared farther from the inspection of the body, that the *superficial* femoral artery, from the place of the ligature downwards, was contracted in diameter, and irregularly obliterated; that is, for three inches and an half below the ligature it was quite impervious; so that it was impossible to pass along it one of the finest probes. From thence downwards, this artery was likewise contracted, but pervious for some space; and this portion was occupied by a firm fibrous coagulum; it was then closed up anew to the vicinity of the ham, where it was all confusion, caries, and corruption.

This case will perhaps seem to some very little in favour of the Hunterian operation; but in my opinion it is very much so. For, it shews, that even in aneurisms of long standing and enormous size, in which every thing would seem to persuade us that the *superficial* femoral artery could not be tied without accelerating the appearance of gangrene in the subjacent leg and foot, the gangrene does not supervene in every case, without exception; since, in the patient of whom we are speaking, the circulation and life were preserved in the left leg and foot for forty days after the operation; and it was not the gangrene of the leg and foot, but the sphacelus of the atonic aneurismal sac, and of the integuments covering it, which, like a malignant vapour, extinguished in a short time the strength and life of the patient.

I forbear here forming any conjecture what would have happened, if instead of evacuating the clots of blood of this large aneurism all at once, the aneurismal sac had been allowed to empty itself slowly; as also to predict what would have been the effects of the slow suppuration of the sac, and of the corrosion of the posterior and inferior surface of the os femoris. I only mention, that in some similar cases, and in those in which the spontaneous obliteration of the *superficial* femoral artery has taken place above the seat of the popliteal aneurism, and then the rupture and spontaneous evacuation of the aneurismal sac, a chronic, sinuous, fistulous ulcer has been formed there, but the life of the patient has been saved.[b]

CASE III.

ANEURISM SITUATED IN THE TOP OF THE CALF OF THE LEG.

CHARLES COMELLO of Casal Monferrato, 46 years of age, a master mason, a man of a good habit of body and tall figure, in the month of September 1803, having mounted to the roof a church, to draw up a beam of enormous size, standing firm upon his legs, made a very violent effort, and, at the height of the exertion, was struck with an acute pain in the top of the calf of the right leg, which obliged him to give over working. Some days after this accident, the patient perceived, that in the lower part of the ham a tumour had appeared as large as a small hen's egg, accompanied with evident, or rather violent pulsation. This tumour was at once recognised by professional persons, to be an aneurism; the seat of which, on account of its being situated very low in the ham, was thought to be in the bifurcation of the popliteal artery. Evacuations of blood were employed for relieving the patient, as also, fomentations of vinegar, and embrocations of equal parts of spirit of wine, and tincture of myrrh; and compression was likewise tried by means of a plate of lead. Nevertheless, the tumour continued to increase, and about the end of February 1804, or at the time the patient was admitted into this school of surgery, the aneurism had increased to the size of a large Portugal orange, and pulsated violently. The subjacent leg, however, was neither painful, numb, nor swoln; and only swelled a little in the evening, when the patient stood long on his feet, or walked more than usual during the day.

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[b] Guattani. de poplitis aneurysm. Hist. v, Masotti sull' aneurisma, pag. 23.

The situation of this aneurism very low in the ham, and properly speaking, at the top of the calf of the leg, presented to me a case quite similar to that described and delineated by Guattani,[c] which kept me a little in suspense. For it occurred to my remembrance, that the very low and deep position of this tumour, Guattani had found to be one of the greatest obstacles which he had met with in the treatment of the disease, and on account of which he confessed at last, that he had been induced to consider it as incurable; since, says he, in similar cases, the compression, on account of the thickness of the parts covering the tumour, becomes painful, and cannot be borne by the patient, and is useless as a method of cure; and the ligature of the artery below the aneurism cannot be applied, without including in the ligature with the popliteal artery, the three principal branches which go down to the leg and foot.

After reflecting more maturely on the above-mentioned circumstances, as I knew, from dissection, that the *inferior* articular arteries of the knee communicate very low in the ham, and, properly speaking, in the calf of the leg, with the trunk of the popliteal artery; that a third *inferior* recurrent articular artery may pour the blood of the *superior* articular arteries into the *anterior* tibial, independent of the channel in the cavity of the ham; that the rupture of the artery never corresponds to the under part, but to the centre or lower third of the whole aneurismal tumour; and finally, that in the case which I had in view, although the rupture of the popliteal artery had evidently taken place at the top of the calf of the leg, yet the pressure produced by the aneurism did not oppose any considerable hindrance to the circulation of the blood in the corresponding leg and foot, I determined upon performing the Hunterian operation on the patient, fully assured, not only of success, but likewise of being able to demonstrate, by this fact, that Mr. Hunter's method is very proper for curing radically even that form of popliteal aneurism, which, from being situated very low down in the ham, or, properly speaking, in the top of the calf of the leg, was conceived by Guattani to be incurable in any other way than by means of the amputation of the leg or thigh.

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[c] Loc. cit. De superioris suræ partis aneurismatibus, pag. 74. Histor. xx, tab. v, fig. 1. See above, chapter ix, § 8.

On the 25th of February, therefore, the patient submitted to the operation, in the presence of a number of students. With two strokes of the knife, the integuments and aponeurosis of the fascia-lata were divided, and the *superficial* femoral artery was brought into view in the upper part of the thigh, the artery was then insulated, and separated from the cellular membrane for the space of an inch, and tied, with the interposition of a roll of linen between the artery and the knot. The whole operation, and the subsequent application of the dressing, were performed in little more than two minutes; which I mention, not from ostentation, for that is far from my character, but only to shew still more the great difference between the easy, expeditious, and little ainful Hunterian operation, and the old mode of operating for popliteal aneurism, difficult in the execution, retarded by many and always new obstacles, and therefore very painful to the patient. Two hours after the operation, the patient complained of a violent sense of pain all round the knee, and of cold and numbness in the points of the toes. An emollient poultice, applied to the knee, allayed the pain in a few hours, and on wrapping the foot carefully in warm flannel, the toes recovered their natural heat. He was ordered an emulsion, with fourteen drops of laudanum in it.

26th.—The following day I found the patient slightly feverish, and complaining of severe pain in the top of the foot; I therefore ordered the whole foot to be covered with an emollient poultice.

27th.—The pain in the foot abated, and the patient rested for some hours. The pulsations of the articular arteries appeared round the knee, which had not been felt before, and during the intensity of the pain in this part.

28th.—The fever was more severe than on the preceding day. The pain recurred on the upper part of the foot, and was again relieved by the application of the emollient poultice. The patient complained of tension in the abdomen, to remove which a glyster was thrown up.

29th.—On renewing the dressings, the wound was found rather pale, moistened with a little ill-formed, serous matter.

1st March.—Towards evening the fever increased, and an erysipelas appeared, extending from the upper angle of the incision, towards the groin and hip.

2d.—The patient took half an ounce of soluble tartar, which procured a copious liquid stool. Notwithstanding the presence of the erysipelas, the wound acquired rather a better colour, and began to discharge laudable pus.

3d.—The erysipelas had receded a little from the groin and hip, but had made its appearance below the inferior angle of the wound towards the knee.

7th.—The succeeding days, to the eleventh, the fever increased anew, as well as the inflammatory painful tension along the course of the *superficial* femoral artery, and it was very evident that the inflammation occupied the soft cellular substance which surrounds and accompanies this artery. Emollient poultices were employed locally, without intermission; and internally, antiphlogistic and slightly acidulous drinks.

11th.—At this period the patient had spontaneous evacuations by stool, of thin matter, with great relief. For the fever immediately began to disappear, and the painful inflammatory tension along the inside of the thigh gradually diminished.

12th.—The spontaneous discharges by stool continued with much relief for several days more. However, there remained an unnatural swelling along the course of the *superficial* femoral artery, and on pressing from the knee upwards, a great quantity of matter, of a dark ash-colour, and very fetid, was discharged from the lower angle of the wound.

18th.—The twenty-first day from the operation, after having separated the flesh from the bottom of the ulcer, by means of the introduction of a compressed piece of sponge, the ligature of the artery came away, and along with it the roll of linen. The patient being rather debilitated, was put upon the use of a decoction of bark, to be taken in the dose of three ounces three times a-day.

20th—Although the patient sat up in bed a few hours every day, and had a good appetite, yet his pulse, especially towards evening, was feverish, and a fetid, sometimes black matter, continued to be discharged from the wound in great quantity; and in addition to this, the swelling had increased on the inner and lower side of the thigh, along the course of the *superficial* femoral artery, and the knee was œdematous; and on pressing the femoral artery with the finger, from the lower angle of the incision towards the knee, a fluctuation was felt, with a sort of gurgling, as of air mixed with pus.

25th.—This occurrence determined me to make, about five inches below the lower angle of the wound, and in the direction of the *superficial* femoral artery, a counter-opening, from which there issued immediately a black very fetid matter, with a burst of air.

26th.—The day after, the upper wound only afforded matter of good quality, and the œdema of the knee disappeared.

27th.—A piece of putrid cellular substance was discharged with the matter. I made a little of the extract of bark, and half a dram of vitriolic ether, be added to the decoction which the patient had been using.

29th.—From this time forward every thing went on better progressively, and, about two weeks after, both the place of the upper incision for the ligature of the femoral artery, as well as the lower incision, or counter-opening, were completely cicatrized, and the patient began to get out of bed. The aneurism at this period was reduced from the size of a large orange to that of a large nut. From the very first moment that the patient began to walk about, he did not complain of any stiffness of the knee, nor of greater weakness in the operated than in the sound limb. Towards night, however, the right foot swelled a little; the swelling was removed, at first by means of a well-adapted expulsive bandage, and then by a boot of linen. About the end of May, the patient had so far recovered his former strength, that he could take long walks; and as, of the whole aneurism of the calf of the leg, there only remained a small indolent tubercle, he returned home and resumed the exercise of his trade.

CASE IV.

POPLITEAL ANEURISM.[a]

A MILLER, about thirty-three years of age, of a good habit of body, was admitted into the hospital of Piacenza the 10th March 1796, on account of a tumour in the right ham, which occasioned him much uneasiness and pain, and prevented him following his trade. I recognized, says Morigi, this disease to be an aneurism already come to a considerable height, as the size of it equalled that of a large fist. I learned from the patient himself, that, six years before, he had been affected with venereal pains, and although he had been cured of these, there remained nevertheless a pain in the great trochanter, with some fulness of the inguinal glands of the same side; which however did not prevent him, before the appearance of the aneurism, following his trade, carrying weights, and taking a great deal of fatigue.

This man was scarcely received into the hospital, when he was attacked by a gastric fever, that prevented the operation, which I would have immediately performed, because the aneurismal tumour had increased very much, the leg was swoln and œdematous, shining, and affected by an extraordinary redness. All these symptoms increased daily more and more, and I almost despaired of being able to have recourse to the operation. At last, after the eleventh day, the patient being free of fever, and having sufficient strength, I resolved upon the operation, which was performed on the 28th March, in the following manner. I placed the patient upon an high bed, opposite to a window; I made him lie not quite on his back, but a little on his right side, and made him extend the thigh and leg; having observed, that on the thigh being extended, the sartorius muscle rises up, and leaves the artery less covered at the lower part of the thigh. In this position I made an incision in the skin and cellular substance along the course of the artery, about four inches and an half in length, the centre of which corresponded to the two lower thirds of the thigh; I then proceeded gradually to lay bare the artery, which I separated carefully from the vein, and having passed under it a double ligature of waxed threads, with a proper instrument, I made with the lower one a single knot, which I drew gradually, and at different times, until I felt the pulsation disappear in the artery below the ligature. I then made another knot, and left the upper ligature in reserve. I brought the lips of the wound together, and kept them so with adhesive plasters; and lastly, I applied a bandage, beginning at the upper part of the thigh, and carrying it as far as the knee. The patient suffered little during the operation. An hour after, on touching his leg, I found it to be a little colder than the other; I therefore made it be rubbed gently with camphorated spirit of wine, and made warm cloths be applied to it. This was continued for some time; the heat then returned to these parts, and afterwards there was no other assistance necessary than some anodyne, and a decoction of bark, on account of a slight fever that had supervened, and on account of the patient's weakness. On the third day I found the suppuration begun, which afterwards increased, and in spite of the bandage applied all over the thigh, the matter formed itself a way along the sartorius muscle, where it formed a sinus as far as the upper part of the thigh. I applied compresses over this sinus, retained by a bandage; and in order that the matter might not stagnate too long, I made the wound be dressed twice a-day.

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[a] This case was communicated to me by my learned and respected friend Dr. Morigi.

On the sixteenth day the ligatures came away spontaneously; the sinus did not discharge any more matter, and the wound was cicatrized, except the place where the ligatures had been.

The twenty-first day an unexpected hemorrhage occurred, which was stopped by the application of the tourniquet upon the place of the ligature. The following day I found a swelling along the sartorius muscle, at the place where the abscess had been, which swelling was produced by blood collected there. I removed the pressure made by the tourniquet, and the blood collected in the sinus ran out. I again applied compresses to the sinus; but observing, that a little florid blood still flowed out from the wound, I applied the tourniquet anew to the same place as before, which had the desired effect; for, three days afterwards, on removing the compression, no more blood appeared. I allowed the patient to move about a little in bed, and on the fortieth day after the operation, being completely cured, he was, five days afterwards, carried to his own house.

I have reason to believe that the above-mentioned hemorrhage had been caused by the imprudent movement of flexion and extension, made by an officious surgeon, who thought that necessary at the time, to prevent an anchylosis.

CASE V.

ANEURISM AT THE TOP OF THE THIGH.

Peter Farinassi, of Turin, hypochondriac and very irritable, reached the age of thirty-four years, without having been affected with any important disease, except gonorrhæas, which he cured, without using mercury either internally or externally. About the end of the year 1800, in the night-time, and while he was asleep, he was attacked by a most severe and painful cramp in the left thigh and leg, with a spasmodic bending of that leg, to get rid of which uneasiness he made a sudden and violent extension of the whole limb. In doing this, he felt as if some filaments had broken at the top of his thigh, and there remained a pain at that part, which continued to trouble him more than twenty days. He was advised to apply warm emollient poultices to the pained place, which afforded him some relief.

Not long after using these applications, a small pulsating tumour appeared at the pained part, which was immediately recognized to be an aneurism. In the course of fifteen months the tumour acquired the size of a large hen's egg, and it was then that the patient came for the first time to Pavia, to have my opinion about it. I advised him to submit immediately to the Hunterian operation, since the circumstances of his disease were very favourable in every respect to the success of that operation.

After returning to Turin, he could not make up his mind to that, and contented himself, for the space of about ten months more, with compressing the swelling, and with losing blood frequently, especially when there was an evident increase of the noise and pulsation of the tumour. In spite of this, the aneurism augmented to the size of a large orange, on the top of which the skin, on account of the uninterrupted pressure upon the tumour, had become livid, thin, and threatened to burst. The base or centre of the aneurism was situated so high in the thigh, that on measuring the distance from the crural arch downwards, there were only two inches, or a little more, between the origin of the *profunda* femoral artery and the tumour. The subjacent leg and foot, however, were not at all preternaturally swelled.

The frequent evacuations of blood, the pains, want of sleep, and continual agitation of mind in which the patient lived, had reduced him to such a state of depression and emaciation, that, on returning to Pavia, he did not appear to be any longer in a condition to undergo a radical cure of his disease. Notwithstanding this, in reflecting upon the smallness of the incision which is made in tying the *superficial* femoral artery, and on the little importance of the symptoms consequent to this incision, I resolved to try it in this patient; the more so, as amputation was inadmissible, and the aneurism threatened to burst.

On the 3^d^ of March 1803, in the presence of a number of students, having placed the patient in an inclined posture on the right edge of the bed, with the left leg and thigh in a state of semiflexion, I placed myself on the right side of the patient, although I was to operate on his left thigh. An assistant was ready to compress the *common* femoral artery at the crural arch, whenever I should order him to do it; another assistant took charge of holding the left knee and leg firm; and a third handed me the instruments. With a convex-edged bistoury I made an incision of the integuments and cellular substance, two inches and an half in length, in the course of the femoral artery, beginning a little above the place where the *profunda* commonly arises. With a second incision, with my hand unsupported, I divided in the bottom of the first the aponeurosis of the fascia-lata, and having introduced the fore-finger of my left hand into the bottom of the wound, I separated the superficial femoral artery from the cellular substance which tied it to the neighbouring parts, and raised it with the point of the finger passed behind it, so that I could see it denuded, and distinct from the great femoral vein, and from the *profunda* femoral artery. Directed by the point of the fore-finger of my left hand, with which I raised the artery, I passed two waxed ligatures, each of them two lines in breadth, from my right to the left, by means of the eyed needle, then withdrawing the fore-finger of my left hand, with which I mentioned that I held the artery raised, and having arranged the ligatures contiguous to each other, I placed a roll of linen on the anterior surface of the artery, upon which I drew the ligatures with a simple knot, and with as much force as was sufficient completely to suspend the pulsations in the tumour, and to place the two opposite sides of the tied artery in firm contact. Over the first knot I made a second; I then cut off the greatest part of the length of the ligatures, nearly to a level with the skin; the wound was filled with soft lint, upon which I placed a compress, supported by a four-headed bandage. The operation was finished in about two minutes, in which short time the patient shewed no symptom of suffering severely. According to the measures which had been taken, the ligature was placed about half an inch below the origin of the *profunda.* I did not think of leaving any ligature as a *reserve*, and the ligature made with the two threads contiguous to each other, with the interposition of the roll of linen, pressed the artery for the space of four lines, without constricting it circularly.

Two hours after the operation, the patient complained of great uneasiness all round the knee, as also of numbness and cold in the extremities of the toes of the corresponding foot. He took an emulsion, with twelve drops of laudanum; bladders filled with warm water were applied round his foot, and the knee was covered with an emollient poultice, which produced the desired effect; as, after two hours and an half, the uneasiness of the knee abated, and the toes became warm.

2^d^.—On the second day, after having passed a quiet night, it was found that the heat of the whole operated limb exceeded that of the sound. On grasping the knee with both hands, the noise and pulsation of the popliteal recurrent arteries, and of their anastomoses, above, and at the sides of the patella, with the collateral arteries of the thigh, was so violent, that they seemed like so many radial arteries. The patient was the first to remark this phenomenon. Towards evening a slight degree of fever occurred.

3^d^.—The third day the fever was rather increased.

4^th^.—The fourth he had passed a quiet night, and the fever was less than on the preceding day.

5th.—The dressings were changed, except the lint, which filled the cavity of the wound, in which the suppuration was not yet fully formed. The aneurism had already considerably diminished in size.

6th, 7th.—The suppuration had not detached the lint from the bottom of the wound. The patient for these two days was very much troubled with a cough. In the evening he had a copious alvine evacuation, by means of a glyster; he took an anodyne arabic emulsion, and sweated during the night.

8th.—The day after, the cough was almost completely gone, and the pulse regular. The suppuration having increased, disengaged the lint from the bottom of the wound.

13th.—The thirteenth day after the operation, the bottom of the ulcer having risen, the ligature appeared nearly on a level with the integuments.

14th.—The day after the ligature came away spontaneously, along with the roll of linen, without occasioning the smallest effusion of blood. The bottom of the wound looked well, granulating not more than a simple ulcer, of small extent and depth, and in fifteen days more it was completely cicatrized. In proportion as the patient recovered his strength, and took nourishment, the aneurism diminished in bulk in every dimension.

On the thirty-fifth day after the operation the patient got out of bed, and walked tolerably well, without the assistance of crutches; and he could not tell which of the two lower extremities was the weakest.

Nine weeks after the operation, the aneurism might be considered as entirely disappeared, since there was not the smallest elevation at the place which it occupied at the top of the thigh, and only on pressing, a small portion of indurated cellular substance was felt there.

The 15th of May of the same year, the subject of this history was radically cured, and returned to Turin, his native place.

CASE VI.

FEMORAL ANEURISM.

Louis Trespi, of St. Zenon, a stout countryman, twenty-five years of age, in attempting to bore a hole with the point of a knife through a thin wooden board, and the better to effect his purpose, having rested it against the inner side of his left thigh, the knife happening to pass through suddenly, wounded the femoral artery about the middle of the thigh. The blood rushed out in great quantity, and *per saltum*; but it was quickly stopped by the bye-standers, by the application of a number of compresses and a circular bandage; after which the patient was brought into this hospital. The surgeon of the ward into which he was put, dreading a renewal of the hemorrhage, did not uncover the wound till eight days after the accident, and then found that it was completely cicatrized. The patient the same day got out of bed, and walked about a little. The next day the surgeon observed that the cicatrix was raised, in the form of a tumour, as large as a small nut, and this tumour pulsated like an artery. Towards evening the patient had a slight degree of fever. The tumour went on daily increasing more and more, and on the eighteenth day after receiving the wound, the whole left lower extremity, from the foot to the knee, was considerably swelled. The following days the fever increased, with great prostration of strength, and the tumour at last was augmented to the size of two thick clenched fists.

Such was the state of the case when I visited the patient for the first time, and directed him to be conveyed into the School of Practical Surgery, where I undertook the operation the 22^d of February 1794. Having made the femoral artery be compressed by a skilful assistant in the vicinity of the crural arch, I laid open, with one stroke of the bistoury, the large aneurism from the top to the bottom, making the incision pass through the middle of the cicatrix of the wound. Having evacuated a large quantity of clots of blood, and dried thoroughly the bottom of the wound, the injury of the *superficial* femoral artery presented itself to me, and it was a little more than three lines long in an oblique direction to the artery. I introduced a large probe within it, with which I raised it, and then easily tied it circularly, and in the usual manner, above and below the wound, leaving besides at the upper part a ligature of *reserve*.[a] I filled the cavity with soft lint, and covered the whole with a compress and a six-headed bandage.

After the operation was finished, which was of short duration, the patient fainted, but he soon recovered by smelling a little vinegar. He then complained of a troublesome creeping sensation through the whole operated limb. He took an emulsion with eighteen drops of laudanum, after which he slept quietly for two hours. On awakening, he said that the operated limb seemed to him to be warmer than the sound one, and it was so in fact. The following day the fever was greater. His pulse, however, was not so small and contracted as before the operation.

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[a] At that time experience had not taught me the great advantages which are derived from the interposition of a roll of linen between the artery and the knot, in order to guard the patient against the risk of subsequent hemorrhage; nor had it demonstrated to me the little or no use which can be made of the ligature of reserve on the occurrence of secondary hemorrhage.

On the fifth day, the swelling, which before the operation extended from the foot to the hip, had almost entirely disappeared, and suppuration had begun; on which account the dressings were renewed.

On the eleventh day an hemorrhagy appeared, which was suppressed partly by drawing the ligature of reserve, but for the most part by means of compression applied to the bottom of the wound against the thigh-bone, by graduated compresses and a circular bandage. On account of this accident, however, the patient's mind was so much affected, that he was seized with convulsive motions over his whole body, which were only removed by a large dose of opium and strong restorative soups. The patient the day after began to take the decoction of bark with a little vitriolic ether in small doses.

On the twentieth day I found the patient quite free of fever. The ligatures were discharged from the wound, except one, which did not come away till the end of the fourth week. The wound notwithstanding became all at once stationary. This was occasioned by a sinus, which extended downwards from the lower angle of the wound for two inches and an half. After it was laid open by the knife, the wound resumed its course towards cicatrization, which was completed by the fifty-second day after the operation.

On the same day the patient got up, and walked a few steps with the assistance of a stick. In three weeks more he recovered his former strength, and left the hospital completely cured. About a year after I saw this man in perfect health, and he assured me that the left limb was as strong as the right, and that he could carry considerable burdens on his back, as he used to do before the occurrence of the accident.

CASE VII.

ANEURISM IN THE BEND OF THE ARM.

Joseph Lucotti, of Volpedo Tortonese, a country man, about 30 years of age, on the 10th August 1799 had himself bled in the right arm, in order to be freed from an obstinate pain in his head. The blood flowed with impetuosity and *per saltum*, and the surgeon had considerable difficulty in stopping it. Three days after, this man observed that he had a small pulsating tumour at the place where he had been bled, which was painful, and prevented him bending and extending his arm freely. The surgeon applied a bit of plaster to it; then perceiving that the tumour increased, he applied a poultice of bread and milk, in order to promote the suppuration in it. Six days after using the poultice the tumour increased to an immoderate size, and had a strong pulsation. The patient then resolved upon coming to this hospital. I was not, however, consulted about the state of the patient till the 22d of September; the whole arm was then prodigiously swelled, and, as it were, phlegmonous. The next day I found it necessary to operate immediately on the patient, as the aneurism had become *diffused*, and threatened the most serious consequences.

Having applied a tourniquet on the humeral artery in the vicinity of the axilla, I made a large incision into the aneurism, following the course of the humeral artery in the bend of the arm, and carrying the incision through the cicatrix left by the lancet. The bloody coagulum rushed out by the large incision, and along with it a little fluid arterial blood; and having dried the bottom of the aneurismal sac with a spunge, the artery immediately presented itself to me, and it was observed to be wounded obliquely for the space of two lines. Through this aperture I introduced a steel probe, with which I raised the wounded artery, while with the fore-finger of the other hand I separated it from the cellular substance, which tied it laterally and posteriorly. I raised it together with the median nerve, from which I easily separated it for a small space above and below the wound. By means of the eyed needle, I passed two ligatures behind the artery, with which making a simple knot, and interposing a roll of linen between the knot and the artery, I tied it above and below the wound made by the lancet. On loosening the tourniquet, no blood flowed from the incision; I therefore filled the whole cavity of the aneurismal sac with soft lint, over which I applied a compress retained by a four-headed bandage; and, lastly, placed the arm in a state of semiflexion. The patient passed the whole day and the following night tolerably well. The morning after, he was seized with nausea, spasmodic constrictions in the fauces, and frequent attempts to vomit, during which he only rejected some frothy saliva. I ordered him the *mixtura ante-emetica* of Riverius, which he rejected the instant after he had taken it. The anxiety and constriction of the fauces increased, the sweat was dropping from his head, and his face became gradually covered with a deadly paleness. A most violent effort at vomiting supervened, during which he threw up by the mouth a living lumbricus worm, a foot in length. After this he felt relieved for fully two hours; then the same symptoms of anxiety, of stricture in the fauces, cold sweat, paleness of face, and vomiting of frothy saliva, recurred as before. Recollecting the good effects which in a similar case I had obtained from fluid quicksilver given in large doses by the mouth, I made the patient swallow about ten drams, by weight, of quicksilver sublimed from cinnabar. As soon as he had taken this remedy, the efforts at vomiting and the stricture of the fauces ceased, and in the space of three quarters of an hour all the alarming symptoms abated, and the patient fell asleep. The remaining part of the day he was able to refresh himself with soup and a few spoonfuls of wine. The following day I ordered him to take powders composed of semen santonici and powder of jalap, and I directed purgative glysters to be thrown up. This had a surprising effect; for he passed by stool a very great mass of lumbrici twisted together, and perfectly similar to that which he had rejected by the mouth; after which he felt himself completely free of every inconvenience of this kind, and recovered his spirits and strength. The suppurative fever came on, and it was very moderate. The fifth day the dressings were removed, and the matter was found to be of good quality, and the ulcer had an healthy appearance. The phlegmonous swelling of the arm had disappeared, and the heat of the hand became two degrees higher than that of the other hand.

On the eleventh day after the operation the lower ligature came away spontaneously, and on the thirteenth the upper ligature of the artery also. There therefore remained only a simple ulcer to heal, which advanced rapidly to cicatrization.

I employed the most unremitting attention in order to prevent the rigidity of the flexure of the arm, directing the operated arm to be brought every day gradually from the state of flexion to that of extension.

On the thirty-fourth day after the operation the wound was completely cicatrized, and the patient left the hospital perfectly cured.

CASE VIII.

WOUND OF THE HUMERAL ARTERY.

Margaret Gherlaschi, of Tor'd'Arese, 40 years of age, weak and emaciated, on the 20th September 1802, in handling a knife, wounded herself on the inner side of the left arm, not far from the internal condyle of the humerus. The vermilion-coloured blood, which issued out *per saltum*, shewed the surgeon of the place that the humeral artery had been wounded. This surgeon succeeded with difficulty in stopping the hemorrhage by means of graduated compresses and a circular bandage, after which the woman was brought to this hospital. The surgeon of the ward in which this woman was placed, after untying the tight bandage, saw only a little blackish half coagulated blood flow from the wound, and observed that there was besides this an ecchymosis, which extended from the wound on the inner side of the arm as far as the axilla, without there being, however, any remarkable swelling of the arm. He therefore contented himself with treating the wound as a simple ulcer.

After seventeen days of this treatment, the ulcer having already contracted very much, and apparently nearly healed, the woman was preparing to leave the hospital. During the night, after having made some violent exertions with the affected arm, she felt that arm become evidently swelled from the elbow to the axilla. In the morning, on uncovering the wound, the surgeon of the ward found a bloody coagulum, as large as the point of the finger, protruding between the lips of the small ulcer. Having been called in, in this state of the case, I found a *diffuse* aneurism extending from the bend of the elbow to the axilla, and therefore proceeded immediately to the ligature of the wounded humeral artery.

A skilful assistant having applied the compression to the brachial artery above the clavicle against the first rib, I dilated the ulcer upwards and downwards, in order to bring the injured humeral artery into view; but it was not so easy, as it usually is immediately after the bleeding, or after the formation of the prominent aneurismal sac, to see the denuded artery in the bottom of the wound, and the wound made in it, and still less to determine with precision the proper place for the application of the ligatures. For although, on suspending the compression above the clavicle, the point from which the arterial blood flowed *per saltum*, pointed out the place where the humeral artery had been wounded, yet on account of the preceding *adhesive* inflammation, and of the subsequent suppuration, there was such a confusion and conglutination of parts to each other, that it was impossible to distinguish properly the trunk of the humeral artery from the rest of the parts, and to insulate it in a convenient manner, in order to tie it with accuracy, and without the interposition of muscular or cellular substance. Therefore, without losing time in painful and useless searches, I formed the resolution of prolonging the incision for some inches upwards along the inner edge of the biceps, and consequently in the direction of the humeral artery. In this manner I brought the humeral artery very quickly into view at a convenient place, and I was able at once to separate it from the median nerve and the vein, and tie it singly with a simple knot, with the interposition of a roll of linen between the artery and the ligature. I did not trouble myself with tying the artery below the ulcer, or at the lower angle of the long incision, both because I would have been unable to distinguish the artery in that intricate mass of substance adhering together, and because I was persuaded that the blood which flowed back from that part might be stopped by means of a moderate compression, and of lint dipped in spirit of wine, with the addition of a few drops of vitriolic acid, which in fact took place.

The lengthening of the incision upwards procured the farther advantage of allowing the discharge of a very considerable quantity of those clots of blood which filled the arm from the elbow to the axilla, in which cavity principally they formed a tumour of prodigious size.

Immediately after the operation, the hand was rather cold, but two hours after it became warm, and towards evening of the same day it was very warm.

Notwithstanding the evacuation of that enormous mass of bloody clots which filled the inner side of the humerus and the cavity of the axilla, it is proper to mention, that the great preceding distension produced by these clots had already brought on an atony of the integuments and subjacent cellular substance of these parts, in a woman previously very much debilitated and emaciated. For, some days after the operation, the integuments burst through all that space, and exposed a foul ulcer, extending from above the *internal* condyle of the humerus along all the inner side of the humerus to the cavity of the axilla. The progress of the corruption was stopped by means of the use of bark both internally and externally, of strong soup, and cordial remedies. And it was worthy of observation, that the portion of the bend of the arm where the artery had been wounded, and where the effused blood had only collected in small quantity, remained unaffected by the corruption, while the other portion was gangrenous from the lower angle of the wound to the axilla.

On the eleventh day after the operation, the ligature of the artery, along with the roll of linen, was discharged spontaneously from the wound. In progress of time, the very extensive ulcer from the elbow to the axilla afforded an healthy suppuration, and in the course of three months, by means of the expulsive bandage applied to each of the fingers, and from thence to the axilla, it at last healed completely.

The first day after the operation, the brachial artery only gave the sensation of a small, deep tremulous motion; afterwards the pulsation of this artery became manifest, and at last even strong. The attention to move the flexure of the arm of the patient every day had the effect of preventing the rigidity from beginning in the bend of the arm. This woman at present makes use of the operated arm with the same facility and strength as she does of the other.

Although the humeral artery had been tied in the lower third of the humerus, in all probability the ligature was made below the origin of the *superior* collateral artery. The hand was cold for two hours, but afterwards became warmer than the other. The great extent of the ulceration from the bend of the elbow along the whole inner surface of the humerus into the cavity of the axilla, with large portions of integuments detached like fringes, and the state of corruption destroying the parts extensively ulcerated, seemed to indicate a general atony of the whole arm. Notwithstanding this, and in spite of the ligature of the trunk of the principal artery of the arm, every thing went on with regularity towards a cure, and nearly as in an arm, the principal artery of which has not been tied.

CASE IX.

CORROSION OF THE HUMERAL ARTERY, OCCASIONED BY GANGRENE OF THE FLEXURE OF THE ARM.

Mauro Cremaschi of Belgiojoso, a boy about 13 years of age, completely blind from his infancy, was brought into this hospital to be cured of a scrophulous ulcer, surrounded with hardness of the cellular substance, and situated in the vicinity of the internal condyle of the right humerus. After this boy had been about a week in the hospital, the ulcer became foul, and at last was attacked by the hospital gangrene. This happened about the beginning of September 1795. The tenth day of the same month there was so great a loss of substance caused by the gangrene, that the ulcer already extended more than three inches above and below the internal condyle of the humerus. On introducing the finger into the bottom of this cavity, the trunk of the humeral artery was felt beating almost quite bare, and it was dreaded, not without great reason, that this artery wonld every moment be corroded, and burst. To add to the distress, the strength of the patient, of a very weakly constitution, was very much sunk, and he was from time to time attacked by subsultus tendinum and hickup. The gangrene was still extending, and prevented the amputation of the humerus.

What I so much dreaded happened the following day. The humeral artery, being corroded, burst. The surgeon in attendance, who never left the patient, applied pressure to the brachial artery above the clavicle, and proceeded immediately to the ligature of the artery, although obscured by the gangrenous substance. Nevertheless, the place of the rupture was discovered, and a probe being passed through it into the tube of the artery, it was raised in the midst of the sphacelus, and tied first above and then below the rupture. The whole wound was sprinkled with powder of bark, and a little camphor, and covered with soft lint, retained by a four-headed bandage. The uninterrupted attention in administering the bark internally, with the addition of vitriolic ether, strong soups given frequently, and a little wine, succeeded in restoring the boy's strength, and rescuing him from danger.

Immediately after tying the artery the pulse disappeared, and the hand became cold; four hours after, however, it became as warm as the other, and the boy complained of a troublesome sensation of creeping in the hand.

12th September. After a copious evacuation by stool, of fluid matter, the patient slept quietly for three hours, and his strength was a little better than before. The hand continued cold. At the wrist a deep trembling was felt in the radial artery, which disappeared if this artery was pressed a little more than usual.

13th.—The heat of the operated hand and arm exceeded that of the sound arm by three degrees. The swelling of the whole arm was very much diminished, and the fever was less than on the preceding day. On removing the dressing, it was found that the gangrene had stopped, and was even disposed to separate at some points.

14th.—The patient has passed a quiet night, and at day-break had a liquid stool, with much relief. The fever is less than yesterday. The gangrene has separated at three places, and has left the subjacent parts of a bright red colour.

17th.—The temperature is the same in both arms; fever very slight. The patient begged earnestly for a little solid food, and he was allowed the quarter of a fowl. He continues to take the decoction of bark, but at longer intervals.

20th.—The gangrene has separated completely, and the wound looks well. The upper ligature of the artery came away with the dressings.

22d.—The lower ligature has likewise come away. The patient is free of fever, and the bottom of the wound nearly on a level with the integuments.

25th.—The operated arm allows itself to be bent and extended easily. The patient himself, with the assistance of the other hand, places this arm slowly sometimes in a state of flexion, sometimes of extension.

29th.—The wound is almost completely cicatrized.

1st October. The little patient passes several hours a-day sitting in a chair, with his arm supported in a sling.

10th.—The wound is completely healed. The patient can move his arm; but he cannot extend it completely, on account of the strong bridles formed by the cicatrix, after so great a destruction by the gangrene of the integuments and cellular substance in the bend of the arm. The pulse of the radial artery is still very weak.

25th.—After frictions several times a-day with warm olive oil and axunge, on the cicatrix and all round the elbow, the patient moves his arm better than before, although he cannot yet extend it fully. At this period he was carried back to his own house, having preserved his arm; which, if the general rules had been strictly adhered to, it seems ought to have been amputated.

CASE X.

SINGULAR CASE OF ANEURISM SITUATED UPON THE SPINE OF THE TIBIA, IN THE VICINITY OF THE KNEE.

A YOUNG countryman, 24 years of age, apparently of a good constitution, had for a long time had a pulsating tumour upon the spine of the left tibia, about six fingers below the patella. The bone of the tibia formed the base of this tumour, and therefore it was hard at its root; but at the apex, and above the spine of the tibia, it was soft, and on applying the hand there, a strong pulsation was felt in it, which raised the hand as a large aneurism does. There was some swelling also behind the tibia, and in the upper part of the calf of the leg; but the greatest elevation of the pulsating tumour, was, properly speaking, upon the spine of the tibia.

On questioning the patient with regard to the origin of his disease, he said, that about seven years ago, an ox had struck him with its horn at that place; that afterwards, a small tumour had appeared there, which however, some days after, disappeared; that for three years subsequent to this accident, he had not felt any inconvenience in that part; that after that time, he had perceived in the same place, or on the spine of the tibia, a pulsating but indolent tumour, the cause of which, had been ascribed to a tight ligature, which he had been accustomed to wear immediately below the knee, and perhaps also to a long journey he had made on foot; that, lastly, the pulsating tumour had increased gradually to the size of the fist, however, without having been obliged on account of it, to confine himself to bed. Doctor Morigi of Piacenza, was the first who examined this patient attentively; and as he was convinced, that the singularity of the case would interest me very much, as in truth it did, he directed the patient to me at Pavia, with permission to retain him in the Practical school, if I chose to do so, for the public advantage.

From the examination which I made, I was clearly of opinion that this tumour was an aneurism. The difficulty turned upon determining, whether the pulsating bloody tumour proceeded from a wound of the popliteal artery, or of the *posterior* or *anterior* tibial arteries, or of the interosseous artery. I was inclined to believe, that it was formed by a rupture of the anterior tibial, and that the extravasated blood, by resting upon the anterior surface of the tibia, and compressing it, had excited the absorption and destruction of a portion of the body of that bone. After considering every thing in relation to the cure, and especially reflecting upon the loss produced in the tibia very near to the knee, I was of opinion, that the amputation of the thigh, or the disarticulation of the leg at the knee, was to be preferred to any other operation. The patient refused to submit to it, and returned to his own home in the district of Piacenza. The patient passed one year more in this state; he then had the misfortune to receive accidentally a blow on the tumour, and to fall several times upon the diseased knee; by which accidents, pain was excited in the place of the tumour. Being incapable after some time of moving about any more, weak and emaciated, he resolved to return again to the hospital of Piacenza, imploring that operation, which a year before he had refused to submit to.

The celebrated Morigi amputated the limb of the patient above the knee, and cured him. Immediately after, he injected the popliteal artery with wax, and sent me the pathological preparation in order that I might examine it.

Having removed the integuments, I immediately proceeded to search for the great arterial trunks of the ham, and I was very much surprised to see, that the popliteal artery, as well as the two tibial and interosseous arteries, were in the most perfectly entire state. Afterwards, what principally fixed my attention was, the finding the aneurismal sac quite covered with arterial vessels, of a much greater size than that of the proper arteries of the cellular substance, and those of the periosteum.

On opening the aneurismal sac according to the length of the spine of the tibia, I found that the sac of it was full of polypous layers after the manner of aneurisms, and that the wax which had been injected by the popliteal artery, was mixed with these layers of blood. The parietes of the aneurismal sac, on removing the polypous layers, were in some places six, in others four, in others three lines in thickness. On examining then attentively the substance composing the parietes of this aneurismal sac, it was evidently that of the periosteum of the tibia, thickened, fleshy, and covered by the compact subcutaneous cellular substance. The inner substance of this sac was villous, irregular, and similar in some measure to the placenta, on the side which is attached to the uterus. On introducing the fingers into the bottom of this aneurismal sac, there were felt fragments of the body of the tibia which had been corroded and absorbed; and it was distinctly perceived, that the lower portion of the body of the tibia was no longer in continuity with the upper; while the thickened periosteum of the portion of the tibia which was wanting, and which formed the aneurismal sac, was in continuity with the periosteum of the rest of the tibia, above and below the corrosion of it. The fibula was untouched.

After cleaning thoroughly the inside of the aneurismal sac, it was wonderful to see from how great a number of arterial orifices the wax injected into the popliteal artery soon after the amputation had been effused into the cavity of the aneurism. After the examination of these parts, I was of opinion, that the disease at first had only been a softening of a portion of the inside of the body of the tibia, followed by an absorption of the substance of that bone from the inner towards the outer side, the periosteum covering it remaining entire, and in a state of perfect vitality; in the second place, that the greater than usual afflux of blood, and of the other humours to that part, had, as usually happens in the capsules of encysted tumours, thickened the periosteum, and greatly enlarged in diameter the proper arteries of this membrane. From the open extremities of these arteries of the periosteum, the arterial blood being poured in great quantity, and with great impetuosity into the cavity left by the portion of the tibia which had been absorbed, this periosteum compressed and thickened, with the addition of the subcutaneous cellular substance, had been converted into a pulsating, or aneurismal sac.

At the time that I was recording the history of this disease, Mr. Pearson published in the second volume of *the Medical Communications*, the account of a bloody pulsating tumour on the spine of the tibia, very similar, as appears to me, to the above described. This author was mistaken, as I was also, in conceiving the proximate cause of the tumour to be a dilatation or rupture of the *anterior* tibial artery. The patient's thigh was likewise amputated, and from the inspection of the amputated parts, Mr. Pearson was of opinion, that the pulsation of the tumour on the spine of the tibia, was to be ascribed to the impulse which the tumour received posteriorly from the popliteal artery. Upon which point it may be remarked, that also in the case described by Mr. Pearson, the injection thrown in by the popliteal artery was poured into the aneurismal sac, without any evident rupture of the great arteries of the ham; and that in the very act of amputating the thigh, as Mr. Pearson remarks, the blood regurgitated from the aneurism by the popliteal artery, with an evident depression of the pulsating tumour occupying the spine of the tibia; which proves, that the arterial blood was easily poured out, and in great quantity from the popliteal artery into the cavity of the tumour, by means of the extraordinary dilatation of the arteries of the periosteum, arising from the popliteal artery.

What happened in the sequel of the cure of the patient, whose history I have here related, confirmed me very much in the above-mentioned opinion, with regard to the nature and proximate cause of this disease. For the patient of whom I have spoken, having enjoyed a very good state of health for five successive years after the amputation, in the winter of 1797, began without any evident cause, either internal or external, to complain of a kind of pain in the extremity of the stump of the thigh. Not long after, the stump enlarged so much, that the patient could with difficulty apply the wooden leg to it, which he had hitherto worn easily. Morigi visited the patient, and besides the increased size of the stump, found, what was still more extraordinary, that the stump itself was an aneurism, or at least that it pulsated after the manner of a large aneurism. The patient after a few days rest in the hospital, left it; but he was not lost sight of. Some months after, it was observed, that not only the stump, but likewise all the rest of the amputated thigh, nearly as far as the loins, was increased in size, and pulsated like an aneurism; and farther, that on handling the remains of the thigh, a crepitation was felt deeply in it, as if fragments of broken bones, an unequivocal proof, that the bony substance had been softened, then absorbed, the soft parts covering the diseased parts remaining untouched. Towards the end of the summer of 1798, this unhappy man, exhausted by a slow fever, came again into the hospital, and died a few days after. The femoral arterial vessels were immediately injected, and the preparation being separated from the pelvis, was sent to me, to be placed along with the first.

On opening the tumour lengthwise, for so the remains of the amputated thigh might be called, I found it full of bloody polypous clots, similar to those which are found in the cavity of an aneurism. The substance of the os femoris had been absorbed through the whole space from the apex of the stump, to the vicinity of the *great* trochanter, and the absorption was about to proceed likewise to the neck of the thigh-bone. The periosteum of all this portion of the thigh-bone, from the stump to the trochanter, had remained untouched, thickened, interspersed with blood vessels very much dilated, and converted into a sheath which supplied the place of an aneurismal sac. Both of these preparations are preserved in the pathological cabinet of this university.[a]

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[a] This case differs essentially from that described by Preussius, inserted in the Ephemerides naturæ curiosorum, an. 1715, cent. iii, iv, observ. xix, under the title, Tumor aneurysmaticus genu sinistri, incisione tandem cauta feliciter persanatus. This tumour was only properly a great ecchymosis, which happened in a nun from long kneeling on the hard ground.

APPENDIX.

[NOTE, No. 1, p. 63.]

Quæsitu dignum multis visum est, cur in aneurysmate effluxus ex arteria ad cutem sanguis et imputris, et immutatus longo satis tempore servetur. Sane vero imputrem multo temporis spatio eum servari certum est, quando gangræna, sphacelus, syderatio, affectuumve sanguinem putrescentem comitantium aliquis, nisi longo tempore intercedente aneurysmati accedat. Illud sanguini huic ex arteria ad cutem effluxo evenire innotuit, quod lacustri aquæ in ipsius lacus alveo imputri permanenti, quanquam non fluat sed persistat. Id propterea fieri philosophorum multi dixerunt, quia quæ assiduo ab ipso lacu educitur aqua, vel a terræ rivis, vel a sole assidue ebibitur, et a flumine, fonte, marive lacum producente assidue, et multo cum fænore resarcitur, et ad illum transmittitur, ut huic motum quemdam aquæ secretiorem corruptionem impedientem colligere liceat; secus ac paludibus eveniat, in quibus cum nihil assidue fluat, et sæpe non refluat, putrescunt majori ex parte aquæ. Pari itaque, aut certe non multum dissimuli ratione, imputris in aneurysmate diu permanet sanguis, quia ob naturalem arteriæ pulsationem a causa præternaturali sine dubio auctam, et ob spirituosam sanguinis arteriosi conditionem, arteriæ foramine illius ingressum, et egressum minime recusante, fluit assidue et refluit in hoc tumore sanguis. Adde et eum qui tumore afficitur, vana quadam evanescentis per

compressionem tumoris delectatione allicitum, sæpius illum comprimere, huicque effluxum sanguinem cum non effluxo misceri, et qui semel exiliit alias intus permanere. Loc. cit.

[NOTE, No. 2, p. 72.]

Except Monro, Hazon, Palletta, Maunoir.

Monro writes, that he considered the true aneurism, so called, as very rare; both because the greater number of cases which we have of this disease are aneurisms from a rupture of an artery, and because, in none of these cases has it been mentioned, that the aneurismal sac was formed of a fibrous layer similar to that of the muscular coat of the artery, as ought to have been the case, if the aneurismal sac had been produced by a dilatation of the tube of the artery. See Monro's works, No. 13.

Hazon has very sensibly expressed doubts on the doctrine generally received with regard to true and spurious aneurisms; observing, 'Facilem hac in re fuisse errori locum. Quippe factitias, vel cellulares quascumque membranas, densas, sanguine indurato, fluidoque distentas pro veris arteriæ tunicis promptum erat accipere, cum tamen diligenti examine, mediis his in cellulis arteria sauciata non dilatata reperiatur.' See Haller Disput. Chirurg. t. v, p. 213.

Palletta. It is conceived, says he, that aneurism is formed for the most part by a certain dilatation or expansion of the arterial coats; I, however, in the dissection of aneurisms, have never found a real dilatation of the arterial trunk. Those who have operated upon aneurisms have never found the trunk of the artery simply dilated. I have always seen a hole in the artery, more or less large, sometimes in form of a rent, sometimes more or less callous, and, as it were, like the orifice of a fistula. See Giornale di Venezia, an. 1796, No. 1.

Maunoir says, 'Prenons un anéurisme de l'aorte pectoral, ou de l'artére pulmonaire; un obstacle à la circulation dans quelque partie, l'action du cœur continuée, et une disposition particuliere dans ces artéres produisent sa dilatation. Mais les tuniques internes ne prétent pas à un développe-

ment etendû ; cette dilatation ne va jamais bien loin. Elles se rompent dans un point et la tunique externe, ou celluleuse fait poche et s'oppose seule à l'effusion du sang, qui passe par la dechirure des tuniques internes. La poche augmente, le sang disseque quelquefois l'artere dans toute sa circonference, et elle se trouve dans le centre de l'aneurisme entierment bagnie dans le sang aneurismal. See Mémoir Physiolog. et Prat. sur l'Anéurisme, p. 30.

[NOTES 3, 4, 5, p. 81.]

Program. de Aneurysm. Vid. Haller Disput. Chirurg. t. v. Pollicis intervallo ab arteriæ magnæ origine cordeque aneurysma ovi minoris magnitudinis in pericardio obortum. Fissura pisum admittebat. Homo derepente mortuus est, effuso sanguine in pericardium.

Acta Medic. Berolin. vol. viii, p. 86. Pericardium autem erat admodum tumidum, quo dissecto ingens quantitas extravasati sanguinis cavitatem vel saccum ejus replebat. Exterso sanguine in conspectum veniebat foramen, vel ruptura ad triobolarem magnitudinem accedens in trunco aortæ, ubi ex sinistro ventriculo cordis procedit. Ubi locus rupturæ penitius inspiciebatur, interior arteriæ tunica in circumferentia aperturæ erosa esse notabatur.

De sed. et caus. Morb. epist. xxvi. art. 7. Magna arteria inventa est rupta qua proxima est cordi; pericardium autem inde plenum omnino coagulati sanguinis.

Art. 17. loc. cit. Mox ea dissecta conspexi toto hoc amplo tractu quo dilatatam aortam fuisse dixi, intus asperam et inæqualem ob rigidas ac duras lamellas osseas, ita crebras atque confertas, vix ut exigua quædam intervalla relinquerent inter se. In quibus intervallis cum arteriæ tunicæ interiores exesæ, et exulceratione quadam attenuatæ perspicerentur, mirum erat uno tantum loco, haud procul a corde, ad posteriorem, eamdemque sinisteriorem partem id demum accidisse, quod tot aliis antea poterat. Scilicet per unum ex hujusmodi intervallis sibi viam sanguis paulatim fecerat, et sub tunicam venerat arteriæ externam, quam ab interioris primum deducendo, attolendoque, sicut ampla quasi ecchimosis docebat, quam ipsi sibi concrescens effecerat, tum deinde magis distendendo, uno in loco perruperat, intraque pericardium se effuderat.

Art. 21. loc. cit. Truncus denique aortæ ipsius ab eo loco unde primum ad superiora emittit ramum, ad cor usque, et maculis distinctus, et sulcis erat exaratus; sed his ita confusis, et abnormibus, ut nihil nisi perpetua, et summa hujus faciei inæqualitas appareret. Sed præter hanc, quædam quasi exulceratio occurrebat, duobus circiter supra semilunares valvulas digitis, qua arteria dexteriora spectat, et posteriora; in eaque exulceratione tria, quatuorve erant profundiora foramina, sed forma angulosa potius quam rotunda. Ab iis obliqui canaliculi extrorsum acti ad exteriorem aortæ laminam pervenerant, multoque humori crassiorem factam, in ejusque rubedinis medio lacerata demum lamina, sanguis sibi viam in pericardium fecerat per foramen interioris simile et ejusdam fere magnitudinis.

Loc. cit. epist. xxvii, art. 28. Arteria magna rupta intervallo digiti circiter transversi. Et ruptio quidem non erat magna; sed prope ipsam, et circa omnem aortæ basem, vetus quasi sugillatio apparebat e nigro sanguine sub exteriore tunica restitante; quæ sugillatio per universum pulmonem se extendebat, præsertim vero circum majoris arteriæ pulmonaris ramos. Præterea facies interior arteriæ magnæ tota erat prominentiis, et pustulis plena, quarum utræque per ejus omnes, quotquot aperti sunt, ramos pergebant. Maunoir Mém. Physiolog. et pratiq. sur l'Anéurisme, p. 36.

[NOTE, No. 6, p. 84.]

De sed. et caus. morb. epist vii, art. 9; xxiv, art. 17; xxvii, art. 2, 20; xl, art. 24; xxiv, art. 16; xi, art. 15. Advers. anat. ii, animad. 41, epist. xxiii, art. 4.—Tota enim aortæ interior facies a corde ad eam usque sedem, quæ orificiis subest arteriarum emulgentium, si cum reliqua usque ad divisionem in iliacas conferretur, manifesto ab naturali, quæ in hac erat albedine, et lævitate ad flavedinem inclinabat, et inæqualitatem, quæ oculis paulo attentius defixis in eo esse videbatur, quod alibi in leves prominentias se attollerent, alibi in exiguos sinus subsideret. Verum hæc omnia superficie tenus; nisi quod paulo supra valvulas arctum erat spatiolum, ubi quasi ab erosione non nihil excavata, divisas quæ suberant fibras ostendebat. In vicinia autem arteriarum emulgentium, lamella intima leviter admoto ungue nullo negotio abradebatur.

Epist. xlv. art. 23. Incisa arteria magna, et sanguine, quo non carebat effuso, ostendit tota interiore facie a corde ad ramos, saltem usque ad emulgentes, particulas quasdam albidiores, et lineas nonnihil extantes; præterea non eo solum, quo modo dicebam tractu, sed et alibi, quantum ex dissectis quibusdam ejus ramis agnovimus, intimam tunicam facile adeo a proxima sejungendam, ut levissimam scalpelli frictionem magna ejus frustula sequerentur.

Epist. xi, art. 15. Præterea in quodam arteriæ magnæ trunculo concretionem, inter tunicas ex flava materia, media inter mollem atque friabilem, parvam illam quidem, sed ita introrsum extuberantem reperimus, ut trunculi cavum angustius faceret.

Epist. iv, art. 21. Arteriæ magnæ truncus a corde ad eum usque locum unde incipit descendere, exterius quidem facie inæquali, non secus ac si in tuberum modum quodantenus hic illic assurgeret; sed interius toto eo spatio nihil nisi superficies rugosa, vix duobus locis, iisque exiguis, indicia nondum maturæ ossificationis.

Epist. xviii, art. 2. Cum enim ab iliacis usque intus esset magnis albidis maculis, incohamentis videlicet futuræ ossificationis ita variegata, ut paucis, parvisque locis secundum naturam se haberet——quo toto tractu lucida intus erat arteria, et inæquali pluribus in locis superficie, eo toto quem modo dicebam tractu, ea potissimum duritie fuit, ut vi etiam magna adacto cultro vix posset discindi, apparente in sectionibus substantia inter cartilaginis, et ligamenti naturam media.

[NOTE, No. 7, p. 84.]

Opusc. Patholog. obs. xxii. In fæmina aorta continuo ubi ex corde prodiit amplissima fuit, ut ambitus quinque unciarum, et duarum linearum esset. In ea dilatatione, quem aorta sedes vertebris nunc vicina terminabat, plurimum fuit quasi ulcerum, cum membrana interior arteriæ in eminentes, fluctuantesque cristas mutata esset, undique lacera, et discerpta.

Obs. xxiii. In ipsa arteria multæ squamæ albæ, callosæ, puri quasi plenæ intercurrerunt, quales supra descripsimus.

Obs. xlvii. Ego vero cum ante aliquot annos adeo frequentes osseas laminas repererim, tandem in viri arteria aorta callosas passim, et flavescentes sedes observari, quæ versus ipsius vasis cavitatem convexæ imminebant; eas aperui; nam membrana interna integra adhuc claudebantur; reperi succum flavum in cellulosam secundam arteriæ clam effusum, quæ inter musculares fibras et intimam tunicam est. Mollis succus erat, pultaceus, non dissimilis ejus qui in atheromate reperitur.——In universum in sanguine materies est apta producendo ossi, quæ adeo frequentur in cellulosum spatium internum, interque convexam superficiem membranæ intimæ arteriarum, concavamque membranæ musculosæ extremitatem effunditur, et caseosa primo, inde callosa, quasi coriacea, demum osseæ squamæ sit simillima. Elem. Physiolog. t. viii, p. 316.

[NOTE, No. 8, p. 84.]

De Aneurismat. part. ii, § 62. Id tamen admiratione, et animadversione simul dignum videtur, spuria nimirum aneurysmata frequentiora esse quam plerique medicorum censeant, ceu iteratæ ostendunt cadaverum incisiones. Quam multos profecto ex forti apoplexia protinus ereptos assidue conquerimur, eosque vere apoplecticos occubuisse dictitamus: attamen dissecto nonunquam cadavere, nullum in nervis et cerebro, aliisque partibus vitium deprehensum fuit, sed arteriæ alicujus disciscio, omniumque tunicarum ejusdem erosio reperta est.

[NOTE, No, 9. p. 84.]

Institut. Medic. t. iv, cap. 11. Sæpe arteriarum tunicæ aut ab acri humore ibi deposito, aut acri ex stagnatione facto intus eroduntur, et sanguinem in pericardium, in pectoris cavum, aut alia proxima loca tam lacerata, ac erosa quam rupta effundunt. Interdum intus osseæ evadunt, aut ossiis squamis obducuntur.

[NOTE, No. 10, p. 84.]

Journal. de Med. de Paris, t. lxxi, p. 141. La crosse de l'aorte considerablement dilatée ; sa face interne noirâtre, et fongueuse avec pluseiurs petits tubercules assez durs, enduite d'un sang grumeleux à demi coagulé, et tres noir. L'epaissure des parties de cette artére etait au moins de deux lignes, et en grande partie formée par la tunique interne, dont le tissu mollasse, et tumefié etait de couleur purpurin, ce qui la faisait aisement distinguer de la tunique charnue, qui la recouvre, laquelle etait saine, et d'un gris jaunatre, c'est à dire, de couleur ordinaire.

[NOTE, No. 11, p. 108.]

A very rare case of extravasated blood, proceeding, according to all appearances, from the minute arterial extremities, or more probably from the weakened, lacerated, or ulcerated veins, was observed by Lamorier, in a Spanish pilgrim about 70 years of age, who had from his birth had a bloody tumour in the right arm, which extended from the shoulder to the fingers. Mémoires de la Société de Montpellier, t. 1, pag. 245. Cette extremité était noirâtre tirant en quelques endroits sur la couleur livide ; elle n'avait par tout guère plus de la moitié de son volume naturel ; elle etait inégale, mais sans dureté ; on n'y appercevait aucune battement, et lorsqu on la pressait avec le doight, on sentait la meme resistance que l'on eprouve lorqu' on manie une rate de veau, ou de mouton distendue par le suffle. D'ailleur, cette partie ne fût jamais douloureuse, et les mouvements n' en furent jamais interrompûs. Lorsq' on piquait le malade avec une epingle, en quelques endroits, que ce fût de l'epaule, du bras et de l'avant bras, ou de la main à la profondeur d' un demi ligne, le sang dardait à la distance d'environ deux pieds sans le secours d'aucune ligature, et il jaillissait pendant une, ou deux minutes. Lorsque le malade elevait le bras sur la tete, on voyait sur le champ se former une tumeur considerable sur l'omoplate, et sur le grand pectoral, àpres y avoir vû discendre à travers la peau le sang depuis les doights, la main, l'avant bras et le bras, et à mesure que ces deux tumeurs se formaient, la main, l'avant bras, et le bras perdoient environ le deux tiers de leur volume.——J'ouvrais la peau pour voir la substance des muscles, et je ne trouvai par tout que de filaments entermelés de vesicules tres dilatés, qui communiquaient les unes aux autres, par de pores tres sensibles. La substance de ces muscles approchait beaucoup de celle de Placenta ; mais beaucoup plus de celle d'une rate de veau, ou de mouton bien distendue par le suffle. Les os de cette partie n'avaient guere plus de la moitié de leur volume naturel ; leur figûre etait irreguliere ; leur surface inégal, et leur substance spongieuse.

This fact, although rare, is not the only one of the kind. Marc. Aurel. Severinus de nov. observatis abs. cap. vii, de abs. sanguifluis, has not only recorded the history of a case very similar to the preceding, but he has likewise given a drawing of it; and it is singular, that the subject of this observation was likewise a Spaniard. In speaking of tumours formed by extravasated blood, this author adds, Sed istos omnes facile superat casus Hispani cujusdam, gracili, adustoque habitu hominis, cui brachium ad summum humerum, et anteriorem thoracem parte quæ alas spectat tam nimium extumuerat, tam ample distentum fuerat, ut confectus dolore perierit. Cujus turgoris immanitatem videre medici et chirurgi omnis sacri incurabilium domicilii; qui tumor sic nobis opificum manu representatus est.

Monteggia mentions, in the firs part of his Institutioni Chirurgiche, cap. vii, § 238, that he had several times seen this disease, and he remarks, that if it is opened, the patient has a very short time to live; for, he is either exhausted by the hemorrhage, or, if the internal concretions close up the vessels, he dies from the gangrenous putridity, which inevitably comes on after the tumour is opened.

I have only once, in the course of my practice, had an opportunity of observing this bloody tumour, which occurred in a priest about fifty years of age, robust, and much addicted to drinking strong liquors. The tumour, about the size of a calf's head, occupied the left axilla, and extended upon the corresponding side of the breast above the clavicle, and over the scapula, nearly as is seen in the figure which Severinus has given of it. The tumour had an elasticity similar to that of the white swellings of the joints, and was not very painful to the touch. It appeared intersected here and there by veins very much enlarged, and the skin at the middle of the tumour, for a certain space was livid, and gave a sensation of a deep seated fluctuation, without there being, however, the smallest pulsation in it. The pains which this patient suffered day and night were very severe; and in the latter periods of his life, he could only lie upon his back, and with his left arm removed as far as possible from his breast. Opium in large doses no longer procured him any relief. All that I could gather with regard to the commencement of this dreadful disease was, that in the month of December 1802, without any evident cause, he felt some pain under the left axilla, which gradually encreased more and more. On examining the part, a tumour was discovered of a moderate size, not at all prominent, and without any change of colour of the skin. This tumour was considered to be of a glandular nature, and as such, treated with resolvents and emollients, in order to bring it to suppuration. In spite of this, the tumour went on increasing rapidly, and in the course of five months, acquired the size I have just mentioned.

To assure myself more fully of the nature of this disease, and in order to try to afford the patient some relief, I perforated the tumour with a small trocar, at the point where the skin was livid, and the fluctuation most evident. About three ounces of black blood were discharged by the canula, with a small quantity of glutinous yellow serum. This was done towards evening, and the patient passed an unusually quiet night; but the day after, the pains recurred with as much violence as before. In the course of a few weeks after the puncture, the integuments mortified at the place where they were livid, and having burst, there protruded through them a substance similar to a sponge dipped in blood, from which there was a constant oozing of black blood, mixed with glutinous serum. The patient was for some days after the rupture of the tumour, free from pain; but his strength being quite exhausted, he soon after expired.

On dissecting his body, I removed that large portion of sponge dipped in blood, which presented itself through the burst skin, which substance on being thrown into water, floated like the lungs. Having washed this substance, I perceived distinctly that it was only the cellular substance of the axilla distended with blood, and similar in some measure to that of the human placenta. I injected water into the large brachial trunks as they pass out of the neck between the scaleni muscles. The water rushed out by an innumerable series of orifices of vessels, evidently corroded, and overflowed everywhere the bottom and sides of the tumour, as if it came from a watering pan, and nearly as is seen in making the injection of the uterus of a woman who has died soon after the extraction of the placenta. There was no indurated gland in the axilla, or in its vicinity. Some of the upper ribs were bare, but not carious. It appears, that in this terrible disease, there happens on a large scale, what we see occur in miniature in those livid spots on the legs, and on other parts of the body of scorbutic persons, formed by an oozing of blood, or rupture of the small arterial and venous vessels.

Besides the upper part of the arm, and in the vicinity of the axilla and scapula, these bloody tumours are likewise formed within the glands of the neck, especially in the thyroid gland, as also within the gland of the mamma affected with scrofula, of which I have lately seen an example in a lady, in whom the right mamma affected with scrofula, acquired in a short time, the circumference of two hand's breadth and an half, from blood effused into the cavity of the mammary gland. These bloody tumours are dis-

tinguished from aneurism by this; that they are not pulsating; that an extravasation of fluid may be immediately discovered in them; that they are surrounded by livid varicose veins; and that they are of a dark colour, where the skin covering them is transparent.

[NOTE, No. 12, p. 241.]

Observ. et Reflex. sur la ligature des principales artéres, pag. 75. L'opération de l'anéurisme par incision du sac exige une incision des tégumens de la longueur de six à sept pouces; on pénétre ensuite à la profondeur quelquefois de trois pouces dans la tissu cellulaire entre les muscles, en tâchant d'éviter le nerf crural. Dans tout ce trajet on peut entéresser des petites artéres qui se distribuent aux muscles, et qu'on doit lier par prudence, Le sac ouvert, on en extrait les caillots et le sang qu'il contient; à différentes reprises, on est dans la nécessité de laver, netoyer, et frotter pour ainsi dire, toute l'étendue de cette énorme surface interieure, soit avec la charpie, soit avec une eponge fine; des aides sont obligés d' écarter les lévres de la plaie pour que l'opérateur voie le fond, et par consequent de les tirailler. La plaie nétoyée, la crevasse artérielle est à decouvert; ce n'est qu'en molestant la partie, que l'on serre les ligatures à cette profondeur. Si quelques collatérales se rendent dans l'artére entre les deux ligatures, ainsi que l'a remarqué Molinelli, comme on est dans l'incertitude sur le point de l'artere qui fournie le sang, on est obligé de faire une compression dans la crevasse artérielle, ou d'y porter des astringens ou des caustiques. La longueur de l'operation, les douleurs qu' éprouve le malade, l' érétisme, le gonflement inflammatoire qui suit de près, et qui est proportionné a l étendue du désordre; ensuite un dégorgement abondant, une grande suppuration, le contact de l'air dans une plaie de cette etendue, les petites foyers purulens qui résultent de sa profondeur, et du rapprochement de ses levres, les sinus qu'on a bien de la peine à tarir, les gonflements subsequens aux quels ils donnent lieu, quelquefois les absces consecutifs; enfin la longueur de la cure, déterminée quelquefois par la cavité qui résulte de la saillie des tendons flechisseurs, quand la jambe ne peut être alongée ; telles sont les suites assez ordinaires de la méthode d'opérer par l'incision du sac anéurisme.

[NOTE, No. 13, p. 246.]

Journal de Méd. de Paris, t. 71, pag. 444. L'injection avait aussi pénetré dans les artéres articulaires tant supérieurs que inférieurs, ainsi que dans les artéres jumelles, mais elle n'avait pû y passer, que des ramifications dans les branches, et dans les troncs : ceuxci n'etaient injectés que jusqu' à une certaine distance de l'artére poplitée, d'ou elles partent, et dans laquelle l'injection n' avait pû pénétrer jusqu' à leur origine ; de sorte que elles n' avaient eté que des moyens de communication, ou des intermedes entre les branches qui descendent de la femorale et des perforantes, et celles des tibiales, tant antérieurs, que posterieurs, qui remontent sur l'articulation. On trouvâ dans l'epaisseur du nerf sciatique une artére assez grosse, qui avait eté aussi injectée, et qui établissait une anastomose, entre l'artére sciatique et la tibiale posterieure. On peut aisément se former l'image de ce qui se passâ lorsque le cours du sang n'eut plus lieu a travers la tumeur, et se rendre raison comment cette rivolution a pû se faire sans que aucun trouble, ni aucun accident en aient eté les suites.

[NOTE, No. 14, p. 258.]

Suite de la nouvelle méthode de guérir les fistules lacrymales. Turin, 1714, pag. 251. We must at least allow, that if, on this subject, Anel had derived instructions from Guillemeau and Thevenin, he has made a very important and useful change in the method practised by these two surgeons ; for they, as appears from their works, as well as Aetius and Paulus, after having applied the ligature to the artery, two or three fingers-breadth above the tumour, opened the aneurismal sac, while Anel left it untouched; in which consists the simplicity of the operation, and the uti-

lity of the discovery. And, in order to remove all controversy on this point of surgical history, I shall here transcribe what the two just quoted authors have written on the subject.

Guillemeau, *Oeuvres de Chirurgie*, *chap*. vi, *p*. 698, relating the history of the cure of an aneurism in the bend of the arm, in the son of a M. de Belleville, enters into the detail of this operation in the following words. Premiérement je remarquay sur le cuir l'artére en la superieure partie de l'avant-bras ainsi qu'elle descend de l'aisselle, au ply du bras, trois doigts au dessus d'iceluy, et en ceste mesme partie suivant ce que j'avais remarqué je fis une simple incision en long au cuir, qui estait comme separé à l'endroit de l'artére, ou elle se rencontre au toucher, et l'ayant ainsi déscouverte, passay par dessous avec une grosse esguille courbe une petite fisselle desliée, puis avec icelle fisselle je liai la dite artére au double noeud; cela fait, tout le sang grouméle, et autre caillé contenu en la tumeur fust ostée, puis les parois de la tumeur furent lavées avec eau de vie, en laquelle j'avois fait dissoudre un peu d'ægiptiac pour corriger la pourriture jà commencée en ceste partie: un mois apres le malade fut parfaitement guery sans estre aucunement estropiat de son bras: de quoy j'ay esté infiniment esmerveillé. Si en quelque autre partie exterieure, il se presente au chirurgien pareil anéurisme il peut seurement découvrir le corps de l'artére vers sa racine et partie superieure, et la lier de mesme façon, sans autre ceremonie.

Thevenin *Oeuvres*, *chap*. xxxviii, *p*. 55. La cure ne reussit pas qu' aux petits anéurismes, ou les artéres sont faciles à lier, et non en celles qui sont à la gorge, aixelles, aynes, et autres parties ou il y a de grands vaisseaux. Si l'aneurisme est petit il se peut lier en la mesme façon que la varice, qui est qu' ayant premiérement decouvert le vaisseau par une incision à la peau, on fait une ligature au dessus et au dessous de l'aneurisme, et on couppe l'artére au milieu. Les autres se contentent aprés avoir decouvert l'artére de la lier seulement au dessus, puis l'ouvrir avec la lancette pour la degorger; par example, si elle est au ply du coude, on fait une incision en long en la partie interieure, et inferieure du bras, à l'endroit ou passe l'artére; laquelle estant decouverte, on la lie de mesme que la varice; puis an ouvre l'anéurisme pour evacuer le sang contenu dans la tumeure; si non, on le peut lier en cette sorte. Le malade estant situé commodément, on passe une grande aiguille enfilée d'une bonne ficelle au travers de bras en la partie interieure et moyenne de l' humerus proche l'os embrassant tous les vaisseau, et ayant mis une bonne compresse large, et epaisse de quatre doigts entre l'entrée et la sortie de l'aiguille, on serre fortement la ficelle; par ce moyen la ligature ne fait si grande douleur, et ne peut coupper les parties qu' elle embrasse. Aprés on fend en long la tumeur qui est au ply du coude, tant pour la dégorger que pour decouvrir le vaisseaux, lequel on lie, et coupe à la façon de la variee, puis on oste la ligature qui est au dessus.

Besides, it is evident, that the two authors just mentioned, in treating of aneurism, have only copied Ætius and Paulus of Ægina, and it clearly appears, that Thevenin proposed sometimes two, sometimes three operations in one for the cure of this disease, while Anel practised one only.

[NOTE, No. 15, p. 340.]

Journal de Chirurg. t. ii, p. 36. Un enfant de six ans de la Paroisse de Belon prés la Ferté-Vidame eut en 1784, l'artére brachiale ouverte dans une saignée de la veine basilique. L' hemorrhagie fût considerable, et le chirurgien eut beaucoup de peine à l'arreter par la compression. Le sang fût cependant contenu; mais il se forma à l'endroit de la saignée une tumeur qui avait un pouce et demi de diamétre. On la traita comme un absces ordinaire avec de maturatifs, et l' on se proposait d' en faire l' ouverture lorsque je fus consulté pour la premiére fois, et que je reconnus tous les signes d' un anéurisme faux. Mon opinion effraya les parents qui appellérent différentes personnes de l' art, dont le jugement fut le meme, et qui opinérent pour l' opération. Choisi pour la faire, je m'en defendis en faisant envisager à la famille les avantages, et les inconveniens qui pouvaient en résulter. J'annonçai qu'il serait toujours temps d' en venir à ce moyen extréme, et je conseillai la compression, en assurant qu'il n' y avait aucune danger de la tenter.

L'inquiétude des parents les determina à conduire leur enfant à Paris, ou l'on consulta à l' hotel dieu M. Ferrant, qui decida l'operation d'une maniére trés pressante. On pris ensuite l'avis de M. Louis, qui se rangea du mien. On eû de nouveau recours à moi. Je plaçai un point d'appui en forme de coussin et un peu fèrme à la partie posterieure du bras et de l'avant bras. J' appliquai plusieurs compresses graduées sur la tumeur, et fis un bendage semblable à celui de la saignée, à cela près, que les tours de bande etaient plus multipliés. Le malade porta ce bendage pendant un an. La tumeur à cette epoque avait entiérement disparu, et l' enfant, qui a maintenant quinze à seize ans, jouit de la meilleure santé. Son bras est de la meme force que l'autre, et conserve la meme grosseur.

[NOTE 16, p. 372.]

Comment. in Aphorism. Boerhaav. t. i, § 161. Vulnerabatur in pago vicino inter pocula rusticus cultro sub axilla, et discissa arteria axillari incredibili impetu exiliebat sanguis: brevi post concidens credebatur expirasse, et pro mortuo deponebatur. Sequenti die dum accedebant illi, qui publica auctoritate occisorum cadavera examinare debebant, ut de vulnerum lethalitate ad judices ordinarios renunciarent, invenerunt aliquem adhuc calorem circa thoracem; cæterum nulla vitæ signa: differebant scrutari vulnus per aliquot horas: incepit sensim parum reffocillari vulneratus, quem tamen brevi periturum existimabant omnes. Sed præter omnium opinionem, diu in summa tali debilitate manens vulneratus evasit tandem. Brachium autem illius lateris aridum, et exsuccum penitus mumiæ fere instar tota vita mansit. Si ergo in tam magna arteria et cordi adeo vicina potuit fieri consolidatio, apparet non tam facile desperandum esse, etiam in periculossissimis vulneribus arteriarum: modo nullis stimulis vinosis, vel cardiacis augeatur debilis vita in talibus vulneratis forte plures evaderent.

[NOTE 17, p. 377.]

Tetr. iv, serm. iii, cap. 10. At vero quod in cubiti cavitate sit aneurysma hoc modo per chirurgiam aggredimur. Primum arteriam superne ab ala ad cubitum per internam bracchii partem delatam signamus: deinde in eadem interna brachii parte simplicem sectionem, tribus aut quatuor digitis infra alam per longitudinem facimus, ubi maxime ad tactum arteria occurrit, atque ea paulatim denudata, deinceps incumbentia corpuscula sensim excoriamus, ac separamus, et ipsam arteriam cæco uncino attractam duobus fili vinculis probe adstringimus, mediamque inter duo vincula dissecamus, et sectionem polline thuris explemus, ac linimentis inditis congruas deligationes adhibemus. Postea vero tumorem in cubiti cavitate, sive flexura securi secamus, nihil amplius verentes sanguinis eruptionem. Tunc grumis evacuatis, arteriam unde sanguis prodiit perquirimus, et repertam uncino attractam, sicut priorem constringimus, ac dissecamus, rursusque thuris polline sectione expleta, puris generationem procuramus.

[NOTE, No. 18, page 377.]

De re med. lib. iv, cap. 37. Quæ vero in extremis partibus, et artubus, aut in capite contingunt aneurysmata, ea sic aggredimur. Si ex apertione tumor factus est, sectionem rectam in longitudinem cuti infligimus; deinde disparatis per hamulos labiis, veluti in vasorum exsectione dicebamus, excoriantes, et per apta ad hoc instrumenta a membranis repurgantes, arteriam nudabimus, et acus sub ea transmissione, et per duo fila deligatione usi, ubi prius intermediam arteriæ partem scalpello punxerimus, et quod continetur in ea evacuaverimus, suppurante curatione utemur, donec deligata filorum vincula excident. Si vero ex arteriæ ruptione deligatio facta est, totum ipsum quantum ejus fieri potest uno cum cute digitis prehendere oportet: deinde infra apprehensam acu traicere, quæ duplicem filum trahat, et post trajectionem, ipsam duplicis fili ansam dissecare, et sic per duo fila tumorem hac illac deligare, veluti de staphilomate dicebamus. Quod si timor sit ne fila dilabantur, etiam alia acus transmittenda est, quæ priorem per totum premat, similiterque duplex filum trahat, et, ansa dissecta, sic per quatuor fila tumorem deligabimus, aut aperto juxta medium tumore, per excretionem ejus quod in ipso continetur, cutem amputamus, et quod deligatum est relicto, et splenio vino et olio imbuto imposito, curatione per linimenta utemur.

[NOTE, No. 19, page 390.]

De cubiti flexuræ aneurysm. obs. iii, iv. Cicatricem igitur ego in basilicæ venæ sede longitudinalem conspiciens, ibidem quoque tuberculum deprehendi spherica donatum figura, cerasumque sua magnitudine adæquans, quod dolore omnino vacuum cum esset, nativoque partis colore præditum, vehementer tamen pulsabat, et sibilo quodam satis violento comitabatur. Tuberculum hoc, si digitis comprimeretur, illico evanescebat, sed illico pariter sui juris factum revertebatur. Satis quoque tactus beneficio patebat memoratum sibilum fieri a sanguine, qui per angustum foramen in tuberculi centrum evibraretur.

In speaking of the second case: accuratam hujus postremi descriptionem omittam; hoc tantum adnotans Morellum hunc xii. kal. Feb. ex sinistro brachio sanguinem sibi detrahi jussisse; ad hæc, intervallo septuaginta quinque dierum, non valde increvisse tuberculum aneurysmaticum, quum magnitudinem hactenus non eccedcret phaseoli, ac denique basilicam venam factam fuisse sensibiliter varicosam; in reliquis enim omnibus hoc aneurysma supra descriptum tuberculum penitus referebat. Negari sane non potest duo hæc allata aneurysmata a duabus differre eorundem speciebus, ad quas post Paulum Eginetam, aneurysmata omnia penes chirurgos redacta sunt. Præter enim memoratum sibilum, ac non naturalem tuberculi pulsationem a brachiali trunco minime dependentem omni modo per solam digitorum pressionem abolitio ejusdem tuberculi, absque eo quod alibi sanguis tumorem pareret, neque veri, neque falsi aneurysmatis ordinarium profecto simptoma fuit. Et revera putandus ne sanguis tam celeriter in eandem arteriam unde prodierat per digitorum pressionem redigi potuisse? Id autem rationi valde consentaneum non est. Si autem ille se in arteriam non infert, quonam quæso abiturus est? per cellularem ne tunicam diffundetur? minime gentium; nam in eadem se ipsum manifestaret. Ad hæc, quomodo intelligi potest tam parvum intra quinque, et septuaginta dies aneurysmatis incrementum? Quomodo poterit varicosa explicari venæ basilicæ affectio? Qua tandem fieri ratione valuit, ut sanguis intra aneurysma perpetuo fluidus permanserit, neque in duram massam concreverit, ut in omnibus, seu veris seu falsis aneurysmatibus jugiter contingere animadvertimus.

Plurima a me instituta in duobus hisce brachiis experimenta, quæ brevitate studens silentio prætereo, me impullerunt ut crederem in utroque aneurysmate venæ basilicæ vulnus, vulnusque subjectae arteriæ brachialis per compressivam cincturam ita invicem in modum anastomoseos coaluisse, ut sanguis a foramine arteriæ prodiens per venæ foramen intra basilicam se recta intulerit, et cum venoso commixtus sanguine breviorem cum eo circulum absolverit. En igitur caussa cur aneurysma tam lente increverit; cur sanguis in illo fluidus permanserit, et cur sola digitorum pressione illico tuberculum penitus evanuerit. Hæc enim omnino, ni fallor, inde fluxisse putanda sunt quod sanguis in venam statim ingrederetur.

The following account of a dissection of the femoral artery is extracted from a memoir of M. Deschamps, inserted in the Mémoires presentées à l'institut des sciences, &c. vol. i, p. 251, an. 1805. See p. 193, and 249.

Galimart, a hackney coachman, 34 years of age, of a good constitution, enjoying in other respects perfect health, on the 7th April 1792, was operated on for a considerable aneurism of the popliteal artery, according to Mr. Hunter's method, in the Hospital la charité. Excepting a slight hemorrhage that occurred on the ninth day, which was quickly stopt, the patient did not experience any accident: he left the hospital completely cured, on the 17th May following, the fiftieth day from the operation. The 21st June, on being presented to the academy of surgery, he enjoyed the perfect motion of his knee; the remains of the tumour were scarcely perceptible to the touch; a pulsation was observed in an artery running on the left side of the knee, near the place where the tumour had been situated: at last he resumed his employment as a coachman.

Galimart died in the Hospital la charité, the 20th October 1799, in consequence of a pulmonary complaint, nearly eight years after the operation had been performed on the popliteal artery.

The following appearances presented themselves in the limb injected, with great attention, from the left internal iliac artery: the arteries were dissected and carefully preserved.

1, The profunda, the size of which is nearly equal to that of the femoral artery, came off at two inches from the crural arch, and gave off the external circumflex artery, about a finger's-breadth from its origin.

2, The femoral and popliteal arteries preserved their natural diameter as far as the tumour, except at the middle of the femoral artery, the place of the ligature, where it was obliterated for the space of two inches and an half: the artery, at this place, did not appear to have been divided by the ligature, as it really was, and the divided parts were not retracted; but, at the time of the dissection, a ligamentous shapeless mass was observed. Below this obliteration, two branches came off from the femoral artery, at an angle rather less than a right angle. The external branch, about a line and a half in diameter, was given off immediately below the obliteration, and ran about seven lines, in which space it received a branch which arose from the femoral artery immediately above its obliteration; it then divided into two branches, the one of which, anastomosed with a branch arising from the same place, which before joining this branch, received another communicating with the femoral artery, two inches and an half higher up; and another, proceeding from above downwards, anastomosed with a branch of the external circumflex.

The other branch given off by the femoral artery, was about 2¼ lines in diameter, situated on the inner side, lower down than the other, about an inch below the obliteration: it ran about the distance of seven or eight lines, and anastomosed with a principal branch of the profunda femoral artery, which appeared either to come from the first perforant, or to be the continuation of the profunda, and with a twig of the inferior branch of the external circumflex, which descending between the rectus and triceps muscles of the thigh, divides into two branches, connected at the lower part by an arch, from the anterior part of which a branch goes off communicating with the superior articular arteries.

The sciatic nerve, in its whole length, was accompanied by several very tortuous arteries of considerable size, arising from the first and second perforant, the superior of which was nearly as large as the radial artery.

3, With regard to the tumour situated immediately above the condyles, it was reduced to the size of a very small olive: it appeared to be formed of a ligamentous solid substance: the popliteal artery, at that place, was obliterated for the space of an inch and seven lines. Above this obliteration, the external articular and several internal articular arteries, of considerable size, came off, among which, a large branch descended on the inner side of the knee, and joined the popliteal artery below the tumour, and before its division into the posterior tibial and peroneal arteries. The other superior internal articular arteries anastomosed with branches of the circumflex, especially with a descending branch of the profunda, in the substance of the middle part of the triceps muscle. The other superior articular arteries, both internal and external, communicated, by means of very numerous anastomoses, with the inferior articular arteries, which, by several ramifications, but principally by two trunks, much enlarged in diameter, communicated with the popliteal artery below the obliteration.

Several branches arising from the popliteal artery, above its obliteration, descended in the substance of the parietes of the old sac, so that, on dissection, they at first appeared to pass through the tumour: these branches afterwards anastomosed with those ramifying on the substance of the parietes of the sac. A branch was observed, nearly a line in diameter, which, turning behind the sciatic vessels and nerve, formed a tortuous arch upon the external condyle of the femur, then proceeded obliquely from below upwards, and anastomosed with the inferior branch given off by the femoral artery below its obliteration, where it has been mentioned it was joined by a branch which seemed to be the continuation of the profunda.

4, The arterial branches which are given off by the trunk of the internal iliac artery, did not appear to be either more numerous, or of larger size, than in the natural state; as their anastomoses with the branches of the profunda did not present any thing worthy of remark, they were not preserved.

From these anatomical observations, M. Deschamps remarks, we may conclude, 1, That the course of the blood, in this subject, was only interrupted in the femoral artery for the space of 2½ inches; that below the obstruction the arterial canal resumed its natural diameter; that the blood was conveyed into it by two enlarged collateral branches. 2, That the blood which passed into the femoral artery below the obstruction, passing from a small into a large canal, lost its impulsive motion; that this blood circulating slowly in the lower part of the femoral artery, had no longer any action either upon the aneurismal sac, which necessarily from the first ceased to increase in bulk, nor upon the mass of blood contained in it, which then, being left at rest, of necessity coagulated. 3, That the blood continued to circulate through the superior articular into the inferior articular arteries, to pass into the popliteal artery below the aneurismal sac. 4, That the constriction of the femoral artery had stopped for a short time, but did not interrupt the circulation in the part below the sac. 5, That it is not so much to the quantity of blood which reaches the tumour that it owes its enlargement, as to the impulse which the sac receives from the column of blood which strikes it every instant.

Cases of Inguinal Aneurism. See page 312.

The cases of inguinal aneurism, cured by the ligature of the external iliac artery, which have, within these few years, occurred in this country, fully justify, in my opinion, the answering in the affirmative the author's questions with regard to the propriety and safety of the operation of tying the femoral artery above the origin of the profunda. The success which has attended these cases naturally leads us to consider, whether, in the cases of femoral aneurism, where the rupture of the artery is supposed to be only about an inch below the origin of the profunda, it would be most expedient to adopt the method recommended by the author, of the incision of the aneurism and the ligature of the artery above and below the wound, or to proceed at once to tie the artery above the aneurism, according to Mr. Hunter's method. Farther, it would also be proper to consider whether the artery should be tied between the epigastric and profunda femoral artery, or above the origin of the former artery. With regard to this point, I am happy to be enabled to state the authority of Mr. Blizard, who very politely favoured me with some remarks on this subject. He observes, that 'if a choice were given of tying the artery of the lower extremity between the epigastric and profunda, or above the epigastric, he is of opinion that the preference ought to be given to the latter situation.' He farther remarks, 'that in the operation of Professor Scarpa, the artery would be tied so near to the origin of the profunda, that the artery most probably would not close.' The whole of this subject, therefore, deserves the most mature reflection; but as my own experience does not afford me any certain rule to lead to the solution of these important points of practice, I must beg leave to refer them to the consideration of those whose situation furnishes them with more frequent opportunities of prosecuting such investigations.

In all the cases of inguinal aneurism alluded to above, the operation was performed by tying the external iliac artery above the crural arch. This attempt was first made by Mr. Abernethy; and although, in the first two cases, it was not attended with ultimate success, the failure seemed to depend on circumstances not immediately connected with the operation: in the third case it proved completely successful. In a letter with which Mr. Abernethy very obligingly favoured me, with regard to these cases, he makes the following remarks: 'When I first tied the external iliac artery, I was, as it were, compelled to do so. The result of this case led me to volunteer the operation in the second, in which it appeared to me to be successful. The death of the patient arose from circumstances not necessarily attendant on the operation. That I judged deliberately and justly, recent occurrences have shewed. I allude to a case published by myself in the Edinburgh Medical and Surgical Journal, to that of Mr. Freer of Birmingham, and to another case, more successful than the former, which was operated upon lately by Mr. Tomlinson of Birmingham.'

In Mr. Freer's case, which is the first where the operation was completely successful, the patient was a stout young man, 27 years of age, and had always enjoyed good health, except occasional confinement from the venereal disease. On his admission into the hospital, the aneurism was as large as a lemon, situated immediately below the crural arch, and extending about five inches down the inner side of the thigh. This swelling was first perceived about four months before, and arose soon after a violent exertion in raising a very heavy weight. The pulsation was very strong; the limb was slightly swelled; the pain, though considerable, did not prevent him walking; and the tumour at first was not discoloured. Notwithstanding the use of repeated venesection, of digitalis internally, and cold applications to the tumour, the disease daily increased; the pain became very severe; the whole limb was affected with œdema; the tumour had augmented to the size of a melon, and threatened to burst; the patient's general health was gradually becoming worse; and he implored relief from his sufferings. In this state Mr. Freer resolved to try Mr. Abernethy's operation, as the only chance of saving the patient. The external iliac artery was accordingly tied above Poupart's ligament, in the presence of several surgeons. I think it unnecessary to detail the steps of the operation, and subsequent treatment, as Mr. Freer has given so accurate an account of them.* It is sufficient, therefore, to observe, that only one ligature was applied to the artery; it came away the fifteenth day, without any hemorrhage. The first week after it came away, no particular change was remarked in the tumour; it then became soft and discoloured on one side, and was thought to be rather increased in bulk; but in a few days it gradually diminished, the discolouration went off, and in the course of a fortnight it was so far decreased in size as to be nearly on a level with the rest of the thigh. The patient in a short time recovered the complete use of his limb, and regained his former health.

In Mr. Tomlinson's case, the operation was performed in the same manner as in Mr. Freer's. The ligature came away on the twenty-fifth day; and the whole cure was not attended by a single unfavourable symptom.

To conclude these remarks, I shall insert the last case, related by Mr. Abernethy in the Edinburgh Journal, as it will serve more fully to elucidate this important subject, and as Mr. Abernethy's mode of operating differs in some points from that of Messrs. Freer and Tomlinson.

Case of Femoral Aneurism, reaching as high as Poupart's Ligament, cured by tying the External Iliac Artery.

JANE FIELD, aged 40, who had been in the habit of drinking to excess, was admitted into S^t. Bartholomew's hospital, with a very large femoral aneurism, reaching as high as Poupart's ligament. The whole limb was œdematous, but in no very considerable degree. She was quite incapable of using the least exercise, or of sitting upright; and, even in bed, she suffered continual pain, which was much aggravated during the pulsation of the aneurism. The pain was so violent as to preclude sleep. She had no appetite; her pulse was feeble and frequent, generally exceeding 100; but her tongue was not furred; and her bowels were regular.

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* Observations on Aneurism, &c. Birmingham, 1807.

On Saturday, 11th October, the operation was performed in the same manner as in the last case. An incision, about three inches in length, was made through the integuments of the abdomen, in the direction of the artery, beginning just above Poupart's ligament. Having divided the skin and aponeurosis of the external oblique muscle, I introduced my finger between the margin of the internal oblique and transverse muscles and the peritoneum. I then divided their lower edges upwards, in the direction of the external wound, to the extent of an inch and a half, with a probe-pointed bistoury. Having thus made room for the admission of my finger, I put it down upon the artery, felt its pulsations, and gently insinuated it beneath the vessel; and then, with the aneurismal needle, passed under it two thick ligatures, carrying them upwards and downwards, as far as the detachment of the artery permitted, and tying them as firmly as I could. I next divided the artery in the interspace, but much nearer to the lower ligature than to the upper one. The wound was afterwards closed, in the middle by a ligature, and in other parts by sticking plaster. Upon removing the patient to bed, she complained of great pain in the wound, and in her head; and was very restless and ungovernable. She wished for something to procure sleep, and I gave her 25 drops of laudanum. This, instead of having the desired effect, made her much more restless; she was continually changing her position in bed, and complaining of violent headach. At night she became more tranquil. The one foot was much colder than the other; but the limbs at the knees were nearly of an equal temperature.

Sunday, 12th, I visited her early in the morning, and found that she had been moderately quiet during the night; that she had suffered much pain in her foot, but none in the wound. The pain in the limb she described as having first attacked the thigh, next the leg, and afterwards the foot, which last pain had now ceased. The foot was warmer than it was the preceding evening, and in a state of perspiration: it was four degrees of heat lower, by Fahrenheit's scale, than that of the healthy limb. The superficial veins of the leg were filled with blood. Her pulse was 96. She had no appetite. I left her with a promise to visit her again at night, recommending her to lie quiet, and take some simple nourishment. About noon, one of the dressers, observing that her skin was hot, and the tongue dry, gave her some saline medicine, with a small quantity of antimonial wine, which occasioned vomiting, and such continued nausea, that she refused all kind of food. The limb, at night, continued in the same state as in the morning. She was free from pain; her pulse 120. As she had had no evacuation, I gave her a pill, containing about 2½ grains of *pil. aloet. e myrrh.* with the same quantity of colocynth, ordering it to be repeated in the morning, if necessary.

Monday, 13th, the foot was nearly of the same temperature with the other. She had two stools, and felt much more comfortable. Still, however, she had an aversion to all kinds of nourishment. Her pulse was 150 and 160, at different times of the day. I may here mention, that every subsequent day she had one or more stools, without having recourse to opening medicine; and whenever she was more irritable or disturbed than usual, she had a tendency to purging. In the evening of this day, I inquired if she had a wish for any particular kind of nourishment; and, at her suggestion, gave her half a pint of porter, with some ginger and toasted bread. This seemed to agree with her stomach, as she slept the whole night, and awoke much refreshed the next morning. Her tongue was then clean; she took some tea and muffin for breakfast, and broth and bread, in moderate quantities, in the course of the day. Half a pint of porter was allowed her at dinner and supper. Her pulse this day, (Tuesday) was 95: the foot warmer than the other. The wound was dressed for the first time; it appeared well closed, and discharged but little. Wednesday, pulse about the same number; had slept during the night, but not so soundly as on the preceding one. The wound and contiguous parts were tender; there was a considerable discharge, which was fetid; the lower ligature came off the artery. The artery, as I have mentioned, was divided very near to the lower ligature; and it is probable, that, in the restlessness of the patient, subsequent to the operation, the motions of the limb had drawn the artery from out of the ligature.*

Thursday, the wound very tender, and the skin had inflamed very much; pulse 84.

Friday, the discharge from the wound less in quantity, and more puriform; pulse the same in number, but very feeble.

Saturday, the patient had been seized in the middle of the night with severe headach and shivering, and in the morning she could eat no breakfast. Her tongue was rather dry, and slightly covered with a brown fur; pulse 95, and feeble. Half a pint of wine was allowed her in sago, in addition to the porter; and she took the *infus. menth. vitriol.* of the hospital, with some tincture of gentian.

Sunday, she was much better; tongue moist and clean, and her appetite much improved. She disliked the bitterness of the medicine; peppermint-water was therefore substituted for the common mint-water, and the tincture of gentian was omitted. Pulse 82; skin cool.

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* I have never made use of the expedient suggested by Mr. Henry Cline, for securing ligatures upon arteries, since I never felt its necessity, and because I have always thought it right to tie a large artery with so thick a ligature, that it would have been unsuitable to the practice which he has recommended. One advantage arising from tying a large artery with a thick ligature is, that it may be drawn as tight as possible, without apprehension of cutting the vessel, or of its speedily coming off from it. Should I, in any future instance, think it right to oppose any mechanical obstacle to the ligature's coming off the vessel which it encircles, I should do it in the following manner, which, by way of suggestion, I take the liberty of mentioning. Having tied a large knot at one end of a small thread, I would pass it, by means of a common sewing needle, through the middle of the artery, in front of the ligature which encircles it; I would then form a second thick knot on the thread, close upon the surface of the vessel. These two knots would, I think, present a considerable obstacle to the slipping of the circular ligature from off the end of the artery.

Monday, in the same state as yesterday; granulations appeared in the wound below the ligature, which closed it in the middle. This part of the wound is now about an inch in breadth, and a third more in length. The wound above the ligature about one fourth of an inch across; and the new flesh, by which it is united, of a tawny colour, and flabby texture. The surface of the skin, to a considerable extent from the wound, red and excoriated.

Tuesday, she had a return of headach, with loss of appetite; her pulse 96. There flowed from the wound a considerable discharge, of an offensive smell, and seemingly irritating to the skin over which it passed. She complained of having had a restless night; and observed that, in general, she found herself well or ill, as the preceding night had passed comfortably or otherwise. Thinking it probable that the irritable state of the wound might contribute, in a great measure, to prevent her from sleeping, I dressed it with an aqueous solution of opium, and smeared the excoriated skin with lard, to prevent the acrimonious discharge from affecting it. All appearance of granulations in the wound had vanished. I ordered her 15 drops of laudanum in her night draught; and, instead of the *infus. menth. vitriol.* I gave her *decoct. cinchon.* ℥ij, with ʒj of *tinct. card. comp.* every four hours.

Wednesday, she had a comfortable night, with much sleep; her pulse 80: the wound greatly amended; the discharge puriform, less fetid, and smaller in quantity; The new flesh above the ligature florid; and granulations appeared again on the sides of the wound, below the ligature. The same treatment was continued.

Thursday, she had not rested so well, and complained of headach. The wound, however, was rather better than on the preceding day. I cut out the ligature which closed the wound in the middle, thinking it might tend to keep up irritation. She attributed the pain in her head to the opium she had taken; to ascertain this point, I ordered the dose to be increased to 25 drops.

Friday, she had slept well, and was free from headach; her pulse under 80. This day, the ligature, from the upper part of the artery, came away with the dressings. The excoriated skin had healed; the redness was inconsiderable. The wound, in every part, had a healing appearance. It seems unnecessary to detail particularly the subsequent part of the case. She was kept in bed to the end of the third week, when she was allowed to sit up, that her bed might be made. I thought this caution requisite, from knowing that ligatures are detached from arteries before the sides of the vessel are united. I also confined her to bed during the whole of the fourth week; but advised her to move the limb about frequently. The wound healed like a healthy wound, and was nearly closed in a month after the operation. During the third week, when the wound no longer proved a source of irritation, her pulse did not exceed 75 strokes in a minute; it was generally lower, and once I found it to be only 68. At the expiration of the month, she got up daily, and walked about the ward; although, on her admission into the hospital, she was incapable of walking at all. There was not the least œdema of the limb: its circumference, at the calf, was but one third of an inch less than the opposite side. Having walked many times the length of the ward, she became tired, and thought that the limb which had been operated on, felt more fatigued than the other. The aneurismal tumour remains at this time of a considerable size. It is certainly more than one third less than at the time of the operation. I have related the case thus particularly, in order that the reader may judge of it for himself. To me it appears, from this and the former cases, that, in an advanced state of femoral aneurism, the artery may be tied above Poupart's ligament, with as little detriment to the circulation of the limb, as in other cases of aneurism, where the operation is attended with very constant success. The symptoms immediately subsequent to the operation, appear to me to have arisen entirely from the irritable and weak state of the patient. She had pain in the head from the operation; and so she had afterwards, whenever her health was disordered by irritation. Her pulse, prior to her taking the medicine which acted as an emetic, was 96; but the subsenerves. The vein was also wounded, but not included in the ligature.

Mr. J. Bell's case of Gluteal Aneurism, see p. 379.

A poor man, a leech-catcher, from the north country, fell on the long-pointed scissars used in his trade, which entered his hip opposite to the place of the sciatic notch, where the gluteal artery comes out of the pelvis. The artery was wounded by the point of the scissars; a profuse hemorrhage ensued; and the patient fainted. The external wound was easily closed; the blood, however, continued to ooze out from the divided artery, and, in the space of six weeks, when he came into the hospital here, had formed a tumour of a very large size; the thigh was contracted; the ham bent; and the whole limb cold, benumbed, and useless.

The tumour, from having acquired so great a size, had lost the usual characters of aneurism: no pulsation could be felt in it. As some uncertainty prevailed with regard to the nature of the tumour, a consultation was called; and it was resolved that a small incision should be made into the tumour, to ascertain the nature of its contents; if it was found to contain matter, that the sac should be laid open; if blood, then it was to be considered as an aneurism, and treated accordingly.

An incision was therefore made into the tumour, and the sac was opened with the point of the knife, and a great quantity of coagulated blood was suddenly discharged. The opening was enlarged, and the clots of blood evacuated till the florid fluid blood began to flow out. The operator then enlarged the incision upwards and downwards; the whole of the clots were cleared out; and the fluid arterial blood rushed forth with such impetuosity, that the patient fainted, his lips and face became livid, no pulsation could be felt at the wrist, and he was supposed to have expired.

Mr. Bell then enlarged his incision still farther, and thrusting his hand to the bottom of the wound, felt the artery beat under his finger; and the lips of the incision being kept separated by the assistants, he passed a ligature round the artery, and tied it above the wound. The artery had been cut completely across. The wound was dressed in the usual manner, and the patient put to bed in the operation room, for he was so much exhausted, that it was judged unsafe to remove him. He passed his fæces and urine involuntarily for some days after the operation, and was long in a very feeble state. However, in the course of seven months he was completely recovered; he was able to resume his trade; the contraction of his leg was removed; he could walk perfectly well, and enjoyed good health.

A case similar to the preceding, occurred to Dr. Jeffrey of Glasgow; but owing to the obstinacy of the friends of the patient, the operation was too long delayed; the tumour burst while the patient was at stool, and he immediately expired.

Mr. Abernethy's case of ligature of the carotid artery, see p. 381.

Mr. Abernethy, in his *Surgical Observations*, relates the case of a man who was gored in the neck by a cow. By this accident, the internal carotid, and all the branches in front of the external carotid artery were lacerated. A profuse hemorrhage soon after ensued, but it was easily stopped, by compressing the trunk of the carotid artery against the lower cervical vertebræ. Mr. Abernethy first endeavoured to secure the bleeding arteries by ligatures; but the edges of the wound were so lacerated, that the ligatures tore away portions of the muscles, without securing the arteries. He then made an incision between the carotid artery and trachea, and passed a ligature round the artery, by means of which, he found that he could completely command the flow of blood from the wound. This ligature was tied, and the lips of the wound brought together with slips of adhesive plaster.

In the evening, about five hours after the accident, the patient's situation seemed much amended; his pulse was moderately full and strong, and not very frequent. During the night, however, he became delirious, and was seized with slight convulsions, which increased during the day; and, in about thirty hours after the ligature was applied to the carotid artery, he expired.

The appearances remarked on dissection, are of such importance, that I shall take the liberty of using Mr. Abernethy's own words. 'The brain,' says he, 'appeared to have suffered a considerable degree of inflammation. The vessels of the pia mater appeared as if they were injected, and in many places, upon the surface of the convolutions of the cerebrum, there even seemed an effusion of blood, producing that appearance usually termed blood-shot. There was a considerable deposition of gelatinous substance between the tunica arachnoidea, and the pia mater. The vessels passing through the substance of the brain, though fuller than common, were not particularly turgid. A considerable quantity of water, of a light brown colour, and slightly turbid appearance, was found in the ventricles, whilst the firmness of the sides of those cavities sufficiently indicated that the collection had not preceded the accident. On examining the neck, the carotid artery was found to be the only part included in the ligature. The superior thyroideal, lingual, and facial branches of the external carotid, were torn off from the trunk, and the internal carotid was rent across.' Mr. Abernethy afterwards very judiciously remarks: 'Upon reflection, I can form no other opinion of the case, than that which first struck me, which is, that though the stopping the supply of blood to the brain did not for several hours produce any apparent derangement in the functions of that organ, yet such a state was gradually occasioned by it, and which was attended, like the effects of concussion of the brain, with inflammation. It further appeared, that when the combined effects resulting from the derangement and the inflammation were manifested together, the state of the patient much resembled that of a person who had suffered concussion.' But I must refer the reader, for a more particular account of this interesting case, to Mr. Abernethy's work.

The two following cases are inserted, to point out an occurrence by which the success of the operation for popliteal aneurism is occasionally prevented, and to show that the gangrene sometimes arises from the collateral arteries not having dilated sufficiently to carry on the circulation independent of the principal trunk. This unfortunate accident is most frequently observed to take place when the soft parts surrounding the knee-joint have been affected with violent inflammation, in consequence of the excessive distention caused by the great size of the aneurismal tumour. The account of the first case, I received from my friend Mr. Langmore, who had the more immediate direction of the patient.

John Williams, seaman, 45 years of age, about six months before he applied for assistance at the London hospital, discovered a small tumour in his ham, which gradually increased to the size of an egg, it gave him no pain, till about a week previous to his being admitted into the hospital. He was operated on for aneurism,[a] Wednesday, July 24th 1804, by Mr. Blizard; after the operation, being put to bed, he took g^{tt} xxx tinct. opii, was free from pain, the leg was well covered with wool. Slept little during that night and next day, but was perfectly easy; his leg was warm, but he complained of slight coldness in his toes; towards evening, however, of that day, the coldness of the toes went off. Friday, four stools, after taking magnes. vitriol ℥j. In the evening, toes being again rather cold, they were rubbed with the hand, and additional wool applied. Saturday morning, one stool, slept well. Sunday, foot and toes rather colder, very good night. Monday, foot cold, discolouration of the integuments, particularly about the ankle. [b]Mist. salin. omitted, ordered to be fomented, and the beer poultice applied to the foot and leg every eight hours, and half a pint of wine in twenty-four hours, and common diet.[c] Tuesday, mortification spreading, fomentation and poultice continued every six hours, ordered ℔j of wine in twenty-four hours, with porter at his dinner, and tinct. opii g 40 hora somni; this day the wound was opened for the first time, it was healed except where the ligatures were. Knee rubbed with lint. camphoræ, had rather a bad night. Wednesday, a pretty good night, mortification spreading. Pulse during the whole of this time regular, and very little increased in frequency, at 12 o'clock took pulv. jalapii ℈j, which procured two stools. Thursday, an indifferent night, no stool, tinct. opii increased ten drops, pulse 100. Friday morning, one stool, had a good night, mortification not spreading, pulse 140, and very small, but towards evening more full and regular, ordered decoct. pulv. et tinct. cinchonæ cum conf. aromat. Saturday, limb much the same, tongue clean, pulse 100, had a good night, no stool. Sunday, indifferent night, one stool, limb the same, pulse 106. Monday, pretty good night, tongue clean, pulse rather quicker. Tuesday morning, pulse 170, very bad night, no stool; in the evening pulse 140. Wednesday, pulse 120, took pulv. jalapii ℈j, after which he had four stools. Thursday, mortified parts beginning to separate, good night, pulse 90 and regular. Friday, had a good night, pulse good, limb the same, one stool, ligatures came away. Saturday and Sunday, remained much the same. Monday, one stool, very good night, pulse regular. Tuesday morning, very indifferent night, pulse 120, and fluttering; at noon more regular; evening, pulse 98, one stool.

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[a] The artery was tied below the under and inner edge of the sartorius muscle.

[b] He took the mixt. salin. from the first of his coming into the hospital, which, after the operation, was continued.

[c] Before this, he was on low diet.

Wednesday, August 14th. Three weeks from the first operation, mortified parts having considerably separated, amputation above the knee was performed by Mr. Blizard: after the operation he was perfectly easy, took 50 drops of tinct. opii; in the evening free from pain, pulse good. From this time till September 9th, 26 days after the second operation, he continued mending, when an abscess was discovered under the fascia of the same thigh, which contained a considerable quantity of matter. From this time he began to sink, and died six days after.

Francis Ballon,* 54 years of age, a grenadier in the regiment of Winning, was admitted into the royal Hospital of la Charité at Berlin, on account of a popliteal aneurism in the right ham, on the 1st April 1804. On his admission, the disease had already advanced so far as to threaten to burst. The swelling in the ham extended about eight inches in length, and was rather larger than an ostrich's egg. On compressing the trunk of the crural artery below Poupart's ligament, the aneurism diminished about one third, and filled itself immediately on the pressure being removed. The skin covering the aneurism was of a dark red colour, and at the part where the tumour came to a point, uncommonly thin and shining. The affected limb had no motion at the knee-joint; and any attempt to move it excited most excruciating pain; and the patient had not been able for four months past to make any use of the limb. In other respects there was no remarkable change of the affected limb below the aneurism. The general health of the patient was not very unfavourable, if we except a slight degree of fever, with quickness of pulse, towards evening.

The patient mentioned, that, about two years before, he had had the misfortune to receive a blow from the pole of a carriage below the ham, and that he had felt a severe pain in that part for a long time, and at last observed a swelling about the size of a walnut. In September last, before going to parade, he struck the outside of this knee with his hand, to dust off some powder that had fallen on his gaiter, upon which a pain suddenly arose in that ham, and he immediately perceived a swelling there; on account of which he was admitted into the regimental hospital.

M. Mursinna, the surgeon-general, saw this patient on the 1st April, and resolved to try the operation for aneurism according to Mr. Hunter's method, which was performed on the seventh.

Two hours after the operation, the leg, as high as the knee, was cold, and evidently swelled. The patient complained of pain at the place of the ligature, and was restless for two hours more, when the upper part of the calf of the leg became warm. He took ten drops of the tinct. opii crocata, and these symptoms soon after abated; and the same dose was repeated about seven o'clock.

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* Extracted from Mursinna's Neues Journal für die Chirurgie, &c. Drittes Stück, 1805.

On the third day the pulse was still full, hard, and frequent; the heat of his skin was moderate; the leg, as far as the ankle-joint, was warm; but the foot was cold, though not without feeling; the skin of the foot was shrivelled, and formed small folds. The patient felt a burning pain at the place of the ligature extending over the whole wound. Soon after the supervention of these pains, an equable heat was diffused over all the limb, which came to a moderate height, and about mid-day was attended with a gentle moisture. Towards evening the folds of the skin of the foot disappeared, and the natural warmth was observed to be returning; the foot retained its natural colour, and was not painful to the touch; but the toes were still shrunk, though not without feeling. On pressing the veins with the finger, the under part swelled, which shewed that the circulation went on, though no pulsation could be felt in the arteries.

The patient was more uneasy on the night between the 11th and 12th April; the pain, in particular, of the affected limb increased very much, and extended upwards to the abdomen along the course of the blood-vessels; the pulse at the same time was small and quick, and the heat very great. A dose of eight drops of the tinct. of opium quickly removed these symptoms; the patient slept quietly for an hour, and drank his coffee with a good appetite at 5 a. m.

In the morning he had a more severe attack of pain in the thigh, but a dose of the tinct. of opium again procured an abatement of these symptoms, and by degrees they entirely disappeared, except a burning sensation which began in the knee, and extended to the sole of the foot. The wound in the thigh was covered with healthy pus, having been dressed for two days preceding with a pledgit of mild ointment.

The aneurism remained the same as it was before the operation.

The patient went on very well till the 19th April. All the toes, except the little one, were extended; and the skin covering them and the foot was of natural colour, and warm.

But towards evening of this day the back of the foot began to swell, and the colour of the skin became darker than before. The temperature of the extremity was increased at this place, especially where the toes join the metatarsal bones.

Friction with a spirituous liniment was repeated every hour, and the limb fomented with a decoction of chamomile and arnica flowers.

On the morning of the following day, after a very uneasy night from the pains chiefly round the knee, the top of the foot was observed to be of a deep purple colour, and covered with small vesicles filled with lymph.

This place was not rubbed any more, but merely fomented with cloths dipped in the same mixture warmed; the friction, however, and fomentation, were continued over the rest of the limb.

On account of these symptoms, the patient was ordered to take a spoonful of an aromatic infusion of bark every hour; and on the pains returning, he took fifteen drops of a mixture of equal parts of tinct. opii. and ether. sulph. The posture of the limb was frequently changed, to prevent, if possible, the increase of the gangrene; but notwithstanding this, on the evening of the twenty-first it passed into sphacelus, and extended, although slowly, as far as the tarsus. It was quite superficial, as was evident from the appearance and feeling of the toes remaining unchanged.

23d.—As the patient nauseated the bark, and had rejected it once, it was omitted, and a spoonful of the following mixture given every hour.

℞ Æther. Sulph. ʒij.
Syrup. Simp. ℥ij.
Aq. Menth. Pip. ℥viij.
Tinct. Cinnam. ʒiij. m.

As Professor Mursinna, in examining the aneurismal tumour, conceived that there was matter in it, a deep fluctuation being felt, he plunged a lancet into the swelling. No matter, however, was discharged, not even fluid blood. Two clots of a coagulum were pressed with difficulty out of the wound after it had been enlarged. As much of the grumous blood was evacuated as possible, to give the joint more freedom, and to assist the circulation, as Professor Mursinna thought that the gangrene of the skin of the foot was to be ascribed to the pressure of the tumour. The gangrene was stationary. This wound was filled with a little charpee dipped in equal parts of camphorated spirit of wine and oil of turpentine, and covered with a pledgit of digestive ointment, retained by slips of adhesive plaster. The wound in the thigh was healing rapidly. The leg was now fomented with dry warm cloths, and it was occasionally wrapt in very warm woollen cloths. The foot was dressed as before.

25th.—The dressings were renewed; and on removing the plasters from the aneurismal tumour in the ham, a quantity of ichorous matter burst out, after which nearly twice as much coagulated polypous blood was pressed out. The lips of the wound were quite flaccid, and the knee-joint collapsed; but nevertheless it still continued very painful when moved, and the pain shooting from it to the abdomen and foot was not abated. The same dressings were applied as the day before. The ligature of the femoral artery came away. This wound was much smaller, and the discharge from it was healthy.

26th.—The gangrene of the foot had increased considerably, and not in the same relation as formerly. A great quantity of acrid fetid ichor flowed from the ham. On dressing it, the articular surfaces of the knee-joint could be distinctly felt bare, and they were discovered to be rough in several places. On moving the knee gently, which was attended with great pain, nearly a cupful of cheesy-like matter was discharged. The fever now began, especially towards night, to suffer an evident exacerbation, with a small, quick, contracted pulse, dry skin, great heat, distressing thirst, and restlessness. The appetite was still good; and on the fever remitting, the patient slept quietly for some hours daily; and he was not much emaciated.

27th to 28th.—No change. To day the patient vomited as he was about to take his mixture, which was therefore omitted, and he only took the tinct. opii when the pains were very severe. The gangrene had extended to the joint of the foot, but did not affect the toes; and a line of separation was observed to be formed. About 2 p. m. the patient had a severe cold fit, which lasted nearly half an hour, and was followed by a dry heat, and at last by sweating. These symptoms altogether continued about two hours, after which the patient slept quietly for five hours, and was much refreshed.

29th.—Had passed a tolerable night; in the morning had profuse sweatings, after which he felt much weaker. The separation of the gangrenous part was more evident, and a tolerably consistent matter was discharged. All the dressings were continued. About one o'clock p. m. the patient had a severe feverish attack, which had the same course as the preceding day; but all the symptoms were more severe, and of longer duration. The sweating also was very profuse and clammy, and during it the extremities were cold. The patient's strength began to sink; his eye was languid and sunk; a diarrhœa and sopor came on; his appetite failed.

30th.—The feverish fit came on about ten, and lasted till five o'clock, and returned at eight in the evening, with a short cold shivering. The diarrhœa increased very much, the symptoms of sopor were greater, his appetite was quite gone, and the wounds discharged unhealthy matter. There could be no hope of the patient's recovery.

1st May.—Subsultus tendinum and hickup came on alternately, the stupor increased, the extremities were cold, the skin was swelled, and covered with a clammy sweat, and the breathing very laborious. The edges of the wound of the knee-joint and of the gangrened spot became discoloured and very foul. The sopor passed into stupor, fæces and urine voided involuntarily, the pulse became small and intermitting, the eyes closed, and he died the 3d May at six o'clock.

DISSECTION.

The limb was injected from the iliac artery the day after the patient's death. The superficial femoral artery was filled with the wax both above and below the ligature, as far as the aneurism. The place where the ligature was applied was completely cicatrized. It was found that the injection had passed into the femoral artery by the articular arteries of the external condyle of the femur, which communicated freely with it, and were very much enlarged. The popliteal artery below the aneurism, or the dilated part, which was about two inches in length, was not filled with the injection. The gangrenous suppuration during the last days of the patient's life had caused a great destruction of the neighbouring parts, and after his death the corruption had increased very much. The profunda femoral artery, and all its branches, were very much dilated, and filled with wax. By means of a branch of this artery, which descends to the patella, and the large branch which supplies the vastus externus muscle, uniting together within that muscle, and afterwards coming out at the outer edge of the ligament of the patella, a communication was formed with the anterior tibial artery. But although this communicating artery was a line and a half in diameter, none of the injection had passed into it or any of the vessels of the leg. The branch supplying the vastus externus at its entrance into that muscle was about the size of a goose's quill, but before it had reached the patella, it had diminished nearly two thirds in diameter.

On examining the knee-joint, the articulating surfaces of the tibia and fibula, and also of the femur and patella, were found carious. The caries extended about three inches above the joint on the posterior surface of the femur, and a still greater portion of the tibia and fibula were destroyed; and there could be no doubt of the caries having existed before the operation. None of the vessels of the glutæi muscles were unusually dilated.

INDEX.

A.

Abernethy's, Mr. case of a wound of the carotid artery, 381, *note*.
———, Mr. cases of inguinal aneurism, 312, *note*.
Abscess sometimes occurs after the operation in the thigh, 272.
Acrell's case of aneurism of the internal carotid, 380.
Acrell, opinion of, with regard to the timely operating in popliteal aneurism, 235.
Ætius' method of tying the brachial artery, 281.
——— mode of operating for the brachial aneurism, 377.
Anel performed the cure of a brachial aneurism, 258.
———'*s* mode of operating for the cure of brachial aneurism, 356.
Antrobus', Mr. case of amputation without hemorrhage, 290.
Aorta, aneurism of the, sometimes accompanied by dilatation, 55.
———, 96, and *note* 100.
———, figures of, 102, 104, 105, 106.
———, obliteration of the arch of the, observed by Paris, 49.
——— ruptured within the pericardium, 81, 82.
———, steatomatous tumours of the, 49.
———, thickening and constriction of the arch of the, 49.
Arnaud's, Mr. case of John Parker, 118.
———, theory of, with regard to the cure of aneurism, 355.
Artery, cellular sheath of the, 68.
———, effects of injecting air into the, 70.
———, rupture of the coats of the, always met with in aneurism, 74, 80.
Arteries, predisposing causes of the ulceration of the, 88.
———, diseases of the coats of the, 89.
Articular arteries beat strongly after tying the femoral artery, 217.
Auricular artery, aneurism of the, 186.

Axillary artery, operation for tying the, 374.
——— tied by M. Desault and Pelletan, 373.
———, cases of a wound of the, 372.
——— *aneurism*, Mr. Keate's case of, 372, *note*, 476.
——— of long standing, operation for the, 376.

B.

Baillie's, Dr. case of obliteration of the femoral artery, 317.
Barbette on the formation of aneurism, 66, *note*.
Bayford's case of aneurism of the arteria innominata, 104.
Bell's, Mr. B. opinion with regard to the aneurismal varix, 393.
———, Mr. J. method of applying the ligature, 282.
———, case of gluteal aneurism, 478.
Bertrandi, mode of ligature mentioned by, 280.
Blizard's, Mr. case of popliteal aneurism, 481.
Blood, absorption of the, after the ligature of the artery, 259.
Bonetus' cases of ulceration of the heart, 87.
Bourdelot's case of brachial aneurism, 335.
Boyer's case of obliteration of the femoral artery, 193.
———, case of popliteal aneurism, 142.
———, dissection of a case of popliteal aneurism cured by the ligature, 250.
Brachial aneurism, description of, 160.
———, proximate cause of, 167.
———, from internal causes, very rare, 174.
———, Flajani's case of, 177.
———, Dr. Monro's case of spontaneous, 174.
———, Paletta's case of, 175.
———, Monteggia's case of, 349, 351.
——— from a large wound, forms quickly, 334.
———, cure of, by compression, 334.
———, case of partial cure of, 344.
———, by Saviard, 345.
———, by Foubert, 346.
———, Desault's bandage for the cure of, 340.
———, Genga's bandage for the cure of, 337.
———, Anel's method of cure of, 258.
———, case of, by Mirault, 258.
———, mode of operating for the, 356, 359.
———, Anel's mode of operating for the, 356.
———, Ætius' and Paulus' operation for, 377, 378.

Brachial aneurism from a large wound, cautions in operating on, 365.
Brachial artery, Deschamps' case of a wound of the, 367.
——————, mode of operating in oblique wounds of the, 370, *note*.
Brambilla's cases of aneurismal varix cured by compression, 394.
Burchall's, Mr. mode of tying the femoral artery, 279.

C.

Causes producing a rupture of the arteries, 83.
Carotid aneurism, Acrell's case of, 380.
———————, Mr. A. Cooper's case of, 382, *note*.
———————, case of, by Harderius, 181, 380.
——————————————— Dr. Piccinelli, 181.
——————————————— Rumlerus, 181.
Carotid artery, Mr. Abernethy's case of a wound of the, 381, *note*, 479.
——————, Hebenstreit's case of a wound of the, 381, *note*.
Celsus, ligature mentioned by, 281.
Chopart found the artery closed at its entrance into the sac, 249.
————, operation of, causes of its failure, 263.
Circulation, rapidity of the, varies at different ages, 220.
————— more free in an aneurismatic limb, 218.
Clarke's, Dr. case of inguinal aneurism, 311.
————, Mr. case of femoral aneurism, 140.
Cleghorn's Dr. case of aneurismal varix, 391, 393.
Cline's, Mr. case of obliteration of the vena cava, 20, *note*.
————, Mr. Henry, mode of preventing the slipping of the ligature, 281, *note*.
Coats of an artery, disorganisation of the, prevents the cure of aneurism, 221.
Compression, manner in which it cures aneurism, 203.
—————— circumstances favourable to its success, 204.
——————————————— preventing its success, 205.
——————, cases in which it ought to be employed, 207, 208.
—————— not to be left off too soon, 343.
—————— applied to the denuded arteries, 208.
—————— symptoms contraindicating the use of, 341.
——————, Genga's mode of applying, 337.
—————— seldom applicable in poplitcal aneurism, 228.

Compression, mode of applying, in popliteal aneurism, 231.
———— must not be continued too long, 234.
———— improper for the cure of femoral aneurism, 296.
———— employed for the cure of aneurismal varix, 394.
Cooper, Mr. A. case of carotid aneurism, 382, *note*.
Crell's case of ossification of the coronary artery, 85.
Crural artery, obliteration of by Baillie, Guattani, Gavina, 22.
Cure, general, of aneurism, 188.
——, incipient spontaneous, related by Desault, 250.
——, spontaneous, of aneurism, singular case of, 190.
—— *of aneurism*, auxiliary means for the, 223.
———— by the supervention of gangrene, 199.
————, causes preventing the, 221, 222.

D.

De Haen's case of aneurism of the external nasal artery, 186.
Desault's account of the effects of the ligature, 210, *note*.
———— bandage for the cure of brachial aneurism, 340.
———— case of ligature of the axillary artery, 373.
———— case of popliteal aneurism, 141.
———— spontaneous cure of popliteal aneurism, 194.
———— operation, not the same as that of Mr. Hunter, 262.
Deschamps' doctrine of true aneurism, 149.
———— opinion of, with regard to the obliteration of arteries, 200.
———— account of the dangers of the old method of operating, 241, and *appendix*, 457.
———— on the advantages of Mr. Hunter's operation, 247, *note*.
———— case of a wound of the brachial artery, 367.
———— case of inguinal aneurism, 319.
Diet of the patient after the operation for aneurism, 270.
Diemerbroeck's, account of the causes of aneurism, 66, *note*.
Dilatation not essential to the formation of aneurism, 53.
Dionis', mode of preventing the ligature slipping from the artery, 281, *note*.
Dod's, Dr. P. account of an aneurism of the aorta, 92.

E.

Ecchymosis the incipient state of an aneurism, 90.
———— observed by Morgagni and Nicholls, *ib.*
Else's, case of extravasation of blood, 108.

F.

Femoral aneurism, cure of, by the incision of the sac, 302.
———— cured by the ligature, 292, 296.
———— *and popliteal aneurism* not preceded by dilatation, 152.
———— *aneurism*, double, case and dissection of, 136.
———— *artery*, ligature of, first performed by Mr. Hunter, 261.
———— *and popliteal arteries*, brittleness of the coats of, 150.
Fernelius' theory of dilatation as the cause of aneurism, 62.
————, refuted by Silvaticus, 63.
Flajani, cases of popliteal aneurism, 130, 131.
Forestus adopted the theory of Fernelius, 63.
Ford's, Mr. case of obliteration of the popliteal artery, 193.
Forster's, Mr. case of femoral aneurism, 299.
———— Mr. Thomson, mode of tying the artery, 279.
Foubert's, theory of the general cure of aneurism, 188.
————, cases of brachial aneurism, 346, 347.
Friend's, Dr. remarks on the subject of aneurism, 67.
Frontal artery, case of aneurism of the, 186.
Freer's, Mr. case of inguinal aneurism, 312, *note*, 469.

G.

Galen's account of M. Bourdelot's case, 335.
———— used the sponge in the cure of brachial aneurism, *ib.*
————*'s* case of a wound of the brachial artery in venesection, 336.
Gangrene sometimes cures an aneurism, 198.
Garneri, observations of, on aneurismal varix, 393.
Gavina, case of inguinal aneurism, 310.
Genga, marks of the brachial artery being wounded, 332.
———— bandage of, described, 337.

Glutæal artery, Theden's case of a wound of the, 379, *note*.
————, Mr. J. Bell's case of a wound of the 478.
Gouey, doctrine of, on the formation of aneurism, 66, *note*.
Greek and *Arabian* physicians only speak of external aneurism, 60.
Guattani's, theory of the formation of the brachial aneurism, 163.
———— on the use of compression in popliteal aneurism, 229.
————*'s* cases of aneurism from a rupture of the artery, 126, 127, 128.
———— description of the dangers of the old method, 239.
———— case of aneurism of the palmar arch, 186.
———— case of aneurism of the tarsus, 187.
———— case of inguinal aneurism, 309, 315.
———— case of aneurismal varix cured by compression, 395.
———— cases of aneurismal varix, 390, *appendix*, 463.
———— case of steatomatous affection of an artery, 123.
Gavina's, case of steatomatous state of the femoral artery, *ib.*
Guerin, objection of, to the ligature of the femoral artery, 249.

H.

Hall's, Mr. case of a wound of the axillary artery, 372.
Haller's experiments on the ligature of arteries, 213, *note*.
———— experiments on the mesentery of frogs, 252.
———— observations on the mesentery of frogs, 164.
————, opinion of, with regard to the ligature of the femoral artery, 215, *note*.
————*'s*, theory of the curative process of aneurism, 189.
Harderius' case of carotid aneurism, 181.
———— case of carotid aneurism, 380.
Heart, ossification of the, 84, 85, *note*.
———— cases of ulceration of the, 87.
———— cases of softening of the, *ib.*
Hebenstreits' case of a wound of the carotid artery, 381, *note*.
Hemorrhage, suppression of, theory of the, 195, *note*.
————, theory of Petit and Morand, 195.
———— *secondary*, causes of, 276, 277.
————, mode of preventing, 277.
Hernu's, case of popliteal aneurism, 134.
Hildanus' account of the proximate cause of aneurism, 65.
———— case of aneurism between the thumb and fore-finger, 187.

Home's, Mr. experiments on the formation of aneurism, 166.
——— Mr. explanation of the renewal of the pulsation, 214, *note*.
——— Mr. case of femoral aneurism, 139.
——— Mr. treatment of the wound after the operation, 285.
Humeral artery, trunk of, always wounded in the aneurism at the bend of the arm, 173.
Hunter's, Mr. experiments on the formation of aneurism, 165.
———, Mr. first proposed the ligature of the femoral artery, 261.
———, Mr. method of, not proper in every case, 263, *note*.
————————, described, 264.
———'*s* Mr. method applicable to the cure of femoral aneurism, 297.
———, Mr. not acquainted with Anel's operation, 261.
———, Mr. used four ligatures in his first case, 268.
———'*s* Mr. case of obliteration of the popliteal artery, 193.
———, Mr. found the artery closed at the entrance of the sac, 249.
———'*s* Dr. William. cases of aneurism of the aorta, 102, 103, *note*.
———, Dr. W. first accurately described the aneurismal varix, 389.

I. J.

Inflammation, adhesive, causes obliteration of arteries, 201.
Inguinal aneurism, cure of, 304, 306, 308, 312, *note*, 318.
————————, Mr. Abernethy's cases of, 312, *note*, 469.
————————, Mr. Freer's case of, 312, *note*.
Internal aneurism, means for retarding the progress of, 224.
Intercostal artery, case of aneurism of the, by Ruisch, 186.
Johnstone on the nature of aneurism, 66, *note*.
————'*s* case of softening of the heart, 87.

K.

Keate's, Mr. case of axillary aneurism, 476.
Kirkland's experiments on the arteries, 196.

L.

Lacoste's, case of femoral aneurism, 298.
La Faye's, opinion with regard to the use of compression, 341.
Lancisi, dissection of an aneurism of the aorta, 91.
——— on the predisposing causes of ulceration of the arteries, 88.
Lassus' case of aneurismal varix in the ham, 384.
Leg, disarticulation of the, recommended, 288, 290.
Ligamentous expansion in the bend of the arm, 171.
Ligature of arteries as a radical cure of aneurism, 209.
———, primary effect of, to divide the coats of the artery, 210, *note*.
———, inconveniencies attending the use of the, 221.
———, phenomena subsequent to the use of the, 243.
——— of the femoral artery, why it ought to be preferred, 244, 246.
———, mode of, proposed by the author, 267, 274.
———, mode of applying the, recommended, 281.
——— of reserve ought not to be employed, 269, 274.
Littre on the constriction of the origin of the aneurism, 75, *note*.

M.

Macgill's, operation of a brachial aneurism, 161.
Marcott's, description of an aneurism of the aorta, 106.
Marks, supposed, of true and spurious aneurisms, 155.
Maunoir's, method of applying the ligature, 282.
Mayer's case of inguinal aneurism, 311.
Meckel's, case of thickening of the aorta, 49.
———, case of ulceration of the aorta, 86.
Mirault on the cure of a brachial aneurism, 258.
Molinelli's, opinion of the formation of brachial aneurism, 161.
——— case of ligature of the brachial artery, 219.
———, objections of, to the use of the ligature, 248, *note*.
———*'s* remarks on the ligature of the nerve along with the artery, 361, *note*.
———, opinion of, on the use of compression, 342.
Monro's, Dr. senior, theory of the formation of brachial aneurism, 162.
———, Dr. primus, dissection of Parker's case, 120.

Monro's, Dr. Donald, case of thickening of the femoral artery, 122.
——————— case of John Parker, 118.
——————— case of femoral aneurism, 141.
Monteggia's, singular cure of a brachial aneurism, 349.
————, case of aneurismal varix cured by compression, 395.
Morand's cases of softening of the heart, 87.
——— theory of the suppression of hemorrhage, 195.
——— case of obliteration of the brachial artery from a blow, 197.
Morgagni observed aneurism accompanied with dilatation, 58.
————s' cases of ruptured aorta within the pericardium, 81.
———— case of inguinal aneurism, 138.
———— case of obliterated vena cava, 201, *note*.
Muraltus, objections of, to the doctrine of Sennertus, 67.
Mursinna's case of popliteal aneurism, 483.

N.

Nicholls, experiments of, on the cellular sheath of the artery, 70, 71.

O.

Obliteration of the artery, only radical cure of aneurism, 191.
———— of the popliteal artery, cases of, 192, 193, 194.
———— of the artery not confined to the place of the ligature, 212.
———— of the brachial artery from a contusion, 197.
Occipital artery, aneurism of, 185, *note*.
Operation, steps of Mr. Hunter's, particularly to be attended to, 274.

P.

Paletta's cases of aneurism of the aorta, 93, 94.
——— cases of femoral and popliteal aneurism, 143, 145, 147.
——— dissection of a popliteal aneurism, 135.
Palmar arch, aneurism situated in the, 186.
Paoli, Mr. on the spontaneous cure of popliteal aneurism, 193.

Paris', case of obliteration of the arch of the aorta, 49.

Park's, Mr. case of aneurismal varix, complicated with aneurism, 398.

Paulus' mode of operating for the brachial aneurism, 377, 378.

Partition separating the artery from the aneurismal sac. 77, 79.

Pelletan's, case of ligature of the axillary artery, 373.

Petit's, theory of the cure of aneurism, 188.

—— diagnosis of true and spurious aneurism, 155, *note*.

—— theory with regard to the clot or couvercle, 354.

—— theory of the suppression of hemorrhage, 195.

—— case of obliteration of the carotid artery, 193.

Pharyngeal artery, rupture of, 187, *note*.

Physick's, Dr. case of aneurismal varix complicated with aneurism, 402, *note*.

Physicians, Berlin, case of rupture of the aorta, 81.

Piccinelli's, Dr. case of carotid aneurism, with dissection, 181.

Popliteal aneurism, dissection of, 133.

————, cure of, 227.

———————— by compression, 227, 228.

———————— by ligature, 235.

———————— by the incision of the sac, 236.

—————— diminution of, after the operation, 254.

—————— of long standing, new method of operating for, 287.

—————— from a wound, cure of, 285, 286.

—— *artery*, case of steatomatous affection of, 124.

Pott, Mr. opinion of, with regard to the incision of the aneurism, 241, *note*.

—————— with regard to the aneurismal varix, 393.

Presse-artére, use of, unnecessary, 275.

Pulsation in the sac sometimes recurs after the artery is tied, 214, *note*.

R.

Radial artery, pulsation of the, stopped by the ligature of the brachial artery, 362.

—————— divides sometimes high up in the humerus, 363.

Riva's, William, account of aneurism of the aorta, 102.

Ruisch's case of aneurism of the intercostal artery, 186.

Rumlerus', case of carotid aneurism, 181.

S.

Sac, aneurismal, structure of the, 153.
—— position of the, favours the spontaneous cure, 196.
—— aneurismal, constriction of the, next to the artery, 75.
—— pressure of the, causes an absorption of the bones, 107.
—— absorption of, explained, 109.
—— aneurismal, rupture of, cause of death, 80.
Salius on the steatomatous state of the arteries, 125, *note.*
Sandifort's, case of ulceration of the aorta, 86.
Saviard's case of incomplete cure of a brachial aneurism, 345.
Schulzius' case of aneurism of the colic artery, 84, *note.*
Sennertus, opinion of, 64, *note*, 65.
———— describes a case of aneurismal varix, 389, *note.*
Severinus' case of femoral aneurism, 294, 303, *note.*
Silvaticus, treatise on aneurism, 60.
Sponge used by Galen to form the compressing bandage, 335.
———————— Mr. White to suppress hemorrhage, *ib.*
Stenzel's case of steatomatous tumours in the coats of the aorta, 49, 85.

T.

Tarsus, aneurism of the, by Guattani, 187.
Temporal artery, aneurism of, from rupture, 185.
—————————————— Palletta's case of, *ib.*
Theden's, case of a wound of the glutæal artery, 379, *note.*
Theory of the formation of aneurism, 53, 54.
Thomson, Professor, on the position of the sac, 196, *note.*
Thomson's, Mr. case of aneurism of the aorta with dilatation, 105.
Toes, mortification of the, after Mr. Hunter's operation, 291.

V.

Vacca's case of popliteal aneurism, 206.
——— dissection after the ligature of the femoral artery, 251.
Valsalva's case of obliterated popliteal artery, 192.
Van-Swieten's case of a wound of the axillary artery, 372.

Vena cava, Mr. Cline's case of, obliterated, 20, *note*.
Vesalius first mentioned internal aneurisms, 59.
Varix, aneurismal, Lassus' case of, in the ham, 384.
—————— sometimes complicated with aneurism, 385, *case*, 398.
—————— diagnosis of from aneurism, 387.
—————— first described accurately by Dr. W. Hunter, 389.
—————— supposed to have been known to Sennertus, *ib.*
—————— Guattani's cases of, 390.
—————— prognosis of, 390.
—————— cure of, 391.
———————— Dr. Cleghorn's suggestion for the, 392.
———————— by compression, 393.
—————— operations for the cure of, 397.
—————— complicated with aneurism, Dr. Physick's case of, 402, *note*.

W.

Walter's case of rupture of the aorta within the pericardium, 81.
Warner's case of popliteal aneurism, 132.
Weitbrecht's case of ulceration of the aorta, 86.
White, Mr. use of the sponge by, 335.
————'*s* dissection of an arm after the ligature of the brachial artery, 217.
Wilmer's case of enlargement of the collateral vessels, 218.
———— Mr. case of amputation after mortification, 290.
Wound, treatment of the, after the operation, 271, 273.
——— lips of ought to be kept separate, 284.

PLATE II

Fig. 1.

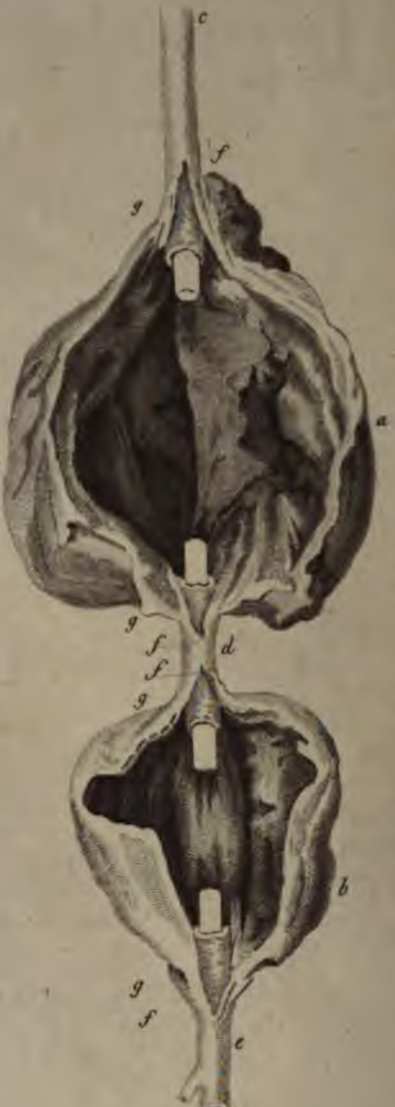


Fig II.

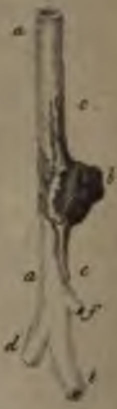


Fig. III.

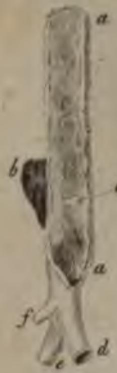
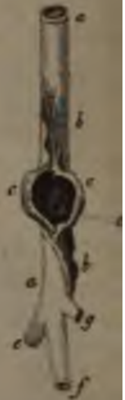


Fig. IV.



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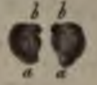

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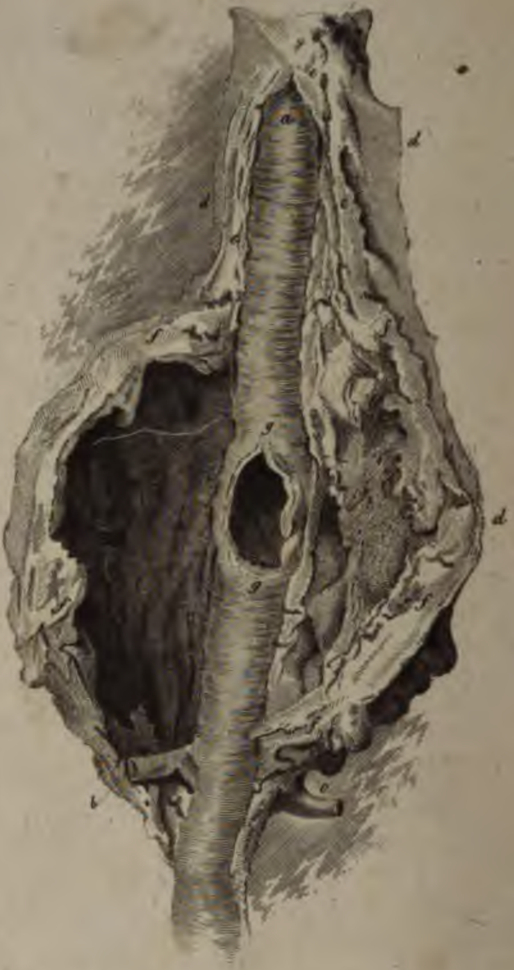
PLATE I



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EXPLANATION OF THE PLATES.

PLATE I.

a, A posterior view of the thoracic aorta, or of the side next to the spine. The external cellular sheath being removed from this artery, shews its proper fibrous or muscular coat.

b c, The emulgent arteries.

d d d, The portion of the pleura which covers the anterior surface of the thoracic aorta.

e e e e, The cellular substance unusually thickened, which lies behind the pleura, and surrounds the thoracic aorta.

f f f f f, This cellular substance converted into the sac of the aneurism.

g g, Rupture of the posterior side of the aorta. At the edge of the rupture is seen the termination of the fibrous layers of the muscular coat of the thoracic aorta.

PLATE II.—FIGURE I.

a, Femoral aneurism situated in the lower part of the thigh, in the vicinity of the place where the femoral artery descends into the cavity of the ham.

b, Popliteal aneurism.

c, Superficial femoral artery.

d, Portion of the popliteal artery between the two aneurisms.

e, Continuation of the popliteal artery.

f f f f, The external cellular sheath of the femoral and popliteal arteries, which contributed to the formation of both of the aneurismal sacs.

g g g g, Portions of the femoral and popliteal arteries covered by their proper muscular coat. See chap. vi, § 19.

FIGURE II.

a a, The left humeral artery at the bend of the arm.
b, A small dark-coloured tumour situated on the external and somewhat posterior part of the humeral artery, about the size of a filbert, enveloped, and attached to the artery by means of the cellular substance surrounding the artery.
c c, A portion of the cellular substance, which after the manner of a sheath surrounded the humeral artery.
d, The ulnar artery.
e, The radial artery.
f, The recurrent radial artery.

FIGURE III.

a a, The humeral artery opened longitudinally on its anterior surface.
b, The small tumour enveloped and attached to the artery.
c, Cicatrix of the internal membrane of the artery.
d, Radial artery.
e, The ulnar artery.
f, Recurrent radial artery.

FIGURE IV.

a a, The humeral artery.
b b, A portion of the cellular sheath of the artery.
c c, A small sac formed by the cellular substance covering the artery externally. This sac was thickened and firm, and resembled the sac of an aneurism.
d, A small pit pointing out the place of the wound made by the lancet. The bottom of this pit was closed up by a substance partly cartilaginous, partly earthy.
e, The ulnar artery.
f, The radial artery.
g, The recurrent radial artery.

FIGURE V.

a a, The lamellated coagulum of blood which was found within the small tumour or sac. Fig. 2. *b*. fig. 4, *c c*.

b b, This coagulum, divided by an incision, is observed to be formed of concentric layers of the crassamentum, and of the fibrous substance of the blood. The fibrine, distinguished from the crassamentum by its whitish colour, terminated in a point, and filled up the pit left by the wound made by the lancet. *Fig.* 4, *a*. fig. 3, *c*.

ERRATA.

P. 76, l. 20, *for* presents, *read* present.
114, l. 6, *for* anuerism, *read* aneurism.
190, l. 1 of note, *for* ou, *read* on
194, l. 7 from b, *for* loose, *read* lose.
214, l. 7, *dele* of.
221, l 24, *for* track, *read* tract.
249, l. 3 from b, *for* case xi, *read* case ii.
258, l. 2 from b, *for* No. 13, *read* No. 14.
261, l. 20, *for* appearance, *read* appearances,

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